MORALE IN VERY OLD PEOPLE
With focus on stroke, depression and survival

Johan Niklasson
Cover picture: *Ingeborg Rapoport defended her thesis in May 2015 at Hamburg University in Germany at the age of 102 years and is thereby the oldest person in the world to defend a thesis. She is a symbol of high morale.*

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“If an author were to consider all the available definitions of morale, his own would be greatly jeopardized and he would become a much older man in the process.”

Mathew Ross, M.D., Washington, D.C., USA

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Abstract

Background: Morale is a multidimensional concept, often defined as a future-oriented optimism or pessimism regarding the problems and opportunities associated with ageing. Very old people, older than 80 years, constitute an age group that is expected to increase in Europe from 4.7% of the general population today to 12.0% in the year 2060 in Europe. The overall aim of this thesis was to explore morale among very old people.

Method: The Umeå 85+/GERontological Regional Database study (GERDA) is a population-based study carried out in parts of northern Sweden and western Finland in which every second 85 year old, every 90 year old and everyone aged 95 years and older were invited to participate. The study started the year 2000 and every five years re-invites previous participants and invites new individuals to participate in the study. The Philadelphia Geriatric Center Morale Scale (PGCMS), which is widely used to measure morale in old people, has been translated into many languages.

Results: There were 598 individuals who answered the PGCMS in the Umeå 85+/GERDA study. Despite respondents’ advanced age 92.6% (554/598) answered 16 or 17 of the questions. The construct validity of the Swedish version of the PGCMS was tested among the 493 individuals who answered all 17 questions using confirmatory factor analysis and the analysis showed a generally a good fit. Reliability tested with Cronbach’s alpha was 0.74. Reliability was also tested in a convenience sample of 54 individuals (mean age of 84.7±6.7 years) and the IntraClass Correlation coefficient (ICC) was 0.89.

Almost 20% (91/465) of participants who could answer the PGCMS had had a stroke. Those with stroke had significantly lower PGCMS scores than those without (10.9±3.8 vs 12.1±3.0, p-value 0.008), but there were 38.5% with stroke history who had high morale. A multiple linear regression analysis showed that depression, angina pectoris and impaired hearing were independently associated with low morale among those with a stroke history.

A logistic regression model showed that each point increase in PGCMS score lowered the risk of depressive disorders five years later (odds ratio 0.779, p<0.001, with each point increase in PGCMS). In a Cox model adjusted for several demographic, health- and function-related confounders, including age and gender, mortality was higher among participants with low morale (RR=1.36, p=0.032) than those with high morale. There was a similar but non-significant pattern towards increased mortality in participants with moderate morale compared to high morale (RR=1.21, p-value=0.136).
Conclusion: The feasibility and psychometric properties of the Swedish version of the PGCMS seems to be satisfactory among very old people. A large proportion of very old people have had a stroke, which is associated with reduced morale. Depression, angina pectoris and impaired hearing were independently associated with low morale among those with stroke. Among very old people, a higher level of morale seems to be associated with a lower risk of suffering from depressive disorders five years later. High morale is independently associated with increased five-year survival among very old people.

### Abbreviations

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<tr>
<td>ADL</td>
<td>Activities of daily living</td>
</tr>
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<td>AGFI</td>
<td>Adjusted Goodness-of-Fit Index</td>
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<tr>
<td>ATOA</td>
<td>Attitudes Toward Own Aging</td>
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<tr>
<td>BMI</td>
<td>Body Mass Index</td>
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<tr>
<td>CFI</td>
<td>Comparative Fit Index</td>
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<tr>
<td>CI</td>
<td>Confidence Interval</td>
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<tr>
<td>df</td>
<td>Degrees of freedom</td>
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<td>DSM-IV</td>
<td>Diagnostic and Statistical Manual of Mental Disorders</td>
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<td>GDS</td>
<td>Geriatric Depression Scale</td>
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<tr>
<td>GFI</td>
<td>Goodness-of-Fit Index</td>
</tr>
<tr>
<td>LD</td>
<td>Lonely Dissatisfaction</td>
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<tr>
<td>MADRS</td>
<td>Montgomery-Âsberg Depression Rating Scale</td>
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<td>MMSE</td>
<td>Mini Mental State Examination</td>
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<tr>
<td>MNA</td>
<td>Mini Nutritional Examination</td>
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<tr>
<td>OBS</td>
<td>Organic Brain Syndrome Scale</td>
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<tr>
<td>PATOA</td>
<td>Positive Attitudes Toward Own Aging</td>
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<tr>
<td>PCLOSE</td>
<td>P value of Close Fit</td>
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<td>PGCMS</td>
<td>Philadelphia Geriatric Center Morale Scale</td>
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<tr>
<td>QoL</td>
<td>Quality of life</td>
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<tr>
<td>RMSEA</td>
<td>Root Mean Square Error of Approximation</td>
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<td>SD</td>
<td>Standard Deviation</td>
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<td>WHO</td>
<td>World Health Organization</td>
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Summary in Swedish (Svensk sammanfattning)

Introduktion: I det engelska språket skiljer man på ”morale” (məˈræl) och ”moral” (məˈrəl), det senare handlar om etik och moral eller vad som är rätt och fel. ”Morale” kan översättas på många sätt men enligt MESH-terminologin1 översätts det som andra, stämning, stridsmoral eller kampvilja. Liknande ord finns i andra språk, t ex tyskans ”geist” eller finskans, ”sisu”. Har en individ stark eller hög ”morale” kan det associeras med ord som stridsmoral, kampvilja eller kampanda. Motsatsen att ha svag eller låg ”morale” kan associeras med uttryck som ”tappa geisten”, ”tappa sugen”, ”förlopa gnistan”, vara ”utbränd”, vara ”demoraliserad” eller uppleva hopplöshet.

Det engelska ordet ”morale” kan användas oförändrat i många situationer och sammanhanget ger betydelsen, medan i svenska språket måste ordet situationanpassas (krig – ”stridsmoral”, yrkeslivet – ”arbetsmoral”, sport – ”kampvilja”, osv). ”Morale” brukar i geriatriska sammanhang definieras som framtidsoptimism eller - pessimism rörande problem och möjligheter associerade med åldrandet. I svenskt språkbruk är det ovanligt att säga att en mycket gammal person har ”stridvilja”, ”kampanda” eller ”framtids-optimism” rörande dennes livssituation. I sökandet efter ett ord som skulle kunna fånga betydelsen i det geriatriska sammanhanget på svenska har ett stort antal svenska synonymer övervägts t.ex livslust, livsmod, livslåga, livskraft, livsvilja, krutgumma/gubbe men även låneorden sisu eller geist som redan finns i svenska språket. ”Morale” brukar i geriatriska sammanhang definieras som framtidsoptimism eller - pessimism rörande problem och möjligheter associerade med åldrandet. I sökandet efter ett ord som skulle kunna fånga betydelsen i det geriatriska sammanhanget på svenska har ett stort antal svenska synonymer övervägts t.ex livslust, livsmod, livslåga, livskraft, livsvilja, krutgumma/gubbe men även låneorden sisu eller geist som redan finns i svenska språket. En möjlighet skulle vara att använda det engelska ordet ”morale” som ett nytt låneord. Att använda ”morale” är knappast att värna om eller värda det svenska språket trots att betydelsen då skulle bli korrekt. Det skulle sannolikt också dröja innan det engelska ordet blev tillräckligt försvenskat för att varje svensk skulle ha en förståelse för dess innebörd. En annan variant är att försöka komma på ett helt nytt ord, som t.ex livsmoral, men det skulle leda till liknande problem som att använda det engelska ordet ”morale”. Efter mycket funderande har vi valt ordet livsnista som vi tycker passar in på den betydelse vi anser att ordet har i det geriatriska sammanhanget. En stor fördel är att ordet redan finns i svenska språket och för de flesta svenskar ger det en ungefärlig förståelse vad det handlar om. Dessutom fungerar det att översätta tillbaka till engelska då det engelska ordet för gnista (”spark”) är en vanlig synonym till ”morale”.

1 "Medical Subject Headings" är en överenskommelse för att göra ord sökbara inom det medicinska forskningsfältet


Philadelphia Geriatric Center Moral Scale (PGCMS) är det mest använda instrumentet för att mäta ”morale”/livsgnista hos äldre och det har översatts till många språk. Den skapades ursprungligen av Lawton 1972 i Philadelphia, USA. PGCMS består av 17 st frågor, där i vissa fall ja- och i andra fall nej- frågor är poänggivande. Svag livsgnista brukar anses ligga mellan 0 och 9 poäng, medelstark mellan 10 och 12 poäng och stark mellan 13 och 17 poäng.

Resultat: Det fanns 598 personer som besvarade den svenska versionen av PGCMS i Umeå 85+/GERDA studien. Trots att de tillfrågade hade hög ålder klarade 92,6% (554/598) att besvara 16 eller 17 av frågorna. Validiteten tes-
Validiteten och reliabiliteten är god för den svenska versionen av PGCMS och visar därmed att den är lämplig att använda bland mycket gamla människor, som dessutom verkar klara av att besvara frågorna i hög uträckning. Ca 20 % av mycket gamla människor har haft stroke och detta är förenat med försvagad livsgnista. Svag livsgnista bland dem med stroke var associerat med depression, angina pectoris och nedsatt hörsel. Bland mycket gamla människor tycks stark livsgnista tycks vara förknippad med lägre risk att drabbas av depressioner fem år senare och stark livsgnista är dessutom oberoende associerat till ökad femårs överlevnad jämfört med personer med svag livsgnista.
Original papers


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Introduction

Morale, often defined as future-oriented optimism or pessimism, is a topic not fully explored among very old people. This thesis examines the validity, reliability and feasibility of the Swedish version of the most commonly used assessment scale for morale, the Philadelphia Geriatric Center Morale Scale (PGCMS), among very old people. Since the PGCMS correlates with quality of life measures, the thesis also explores the use of morale as an outcome measure, i.e. the PGCMS is used as a measure of quality of life specifically to compare individuals who have had a stroke event earlier in life compared to those who have not. Morale is also used as an explanatory variable, i.e. to see if an individual’s level of morale can be associated with the incidence of depressive disorders five years later or the five-year survival rate among very old people.

The normal ending to a fairy tale, “...and they lived long and happily ever after”, focuses on the dream many of us share of a good ageing which is both long and happy. However, though many of us desire it, we do not fully understood how to achieve good aging. Further research is needed.

A long life

Life expectancy is increasing in most countries around the world, bringing with it a rapid rise in the number of senior citizens. Sweden together with four other countries in the world (France, Germany, Italy, Japan), have populations where those older than 80 years now constitute more than 5% of its population (United Nations, 2009). The age group expected to increase the most in Europe in the coming years is that of 80-year-olds and older, rising from 4.7% today to 12.0% in 2060 (Eurostat, 2012).

Several age-related dimensions can be used to describe an ageing population two of which will be presented here. Presented here first, is the most common age of death based on the number of deaths per age (Figure 1). In Sweden in 2012 it was 88 years for women and 86 for men (Statistiska centralbyrån, 2015c). This is arguably one of the better ways of describing when old people in Sweden normally die.
Second, life expectancy (in Swedish “förväntad livslängd”) is a measure that combines the mortality rates at different ages and is probably the most frequently used age-related measure. In Sweden in the year of 1861 it was below 50 years (Statistiska centralbyrån, 2015a) and in Sweden in 2014 it was 84.1 years for women and 80.4 years for men. Two-thirds of all women in Sweden die in the age range 80-99 years and only 10% of all women who died in 2014 were under the age of 65 years. Half of all deaths among men in Sweden were in the age range of 80-99 years and 16% of men who died in 2014 were
under 65 years old (Statistiska centralbyråns, 2015b). The reasons for the higher mortality among young men are greater number of suicides and accidents and higher alcohol consumption. After the age of 40, the excess mortality in men is explained by more deaths from cardiovascular disease (Statistiska centralbyråns, 2015e). Since death rates are very low in the younger ages (before the age of 65), the increase in longevity comes from a reduction in death rates after the age of 65 (Statistiska centralbyråns, 2015a).

The life expectancy of men is increasing faster than that of women and since 1979 the gender gap has decreased from 6.2 years to 3.7 years (Statistiska centralbyråns, 2015b). The increase in life expectancy has been highest for highly educated men and lowest for women with low education. High education is supposed to lead to less risky behavior such as smoking and alcohol consumption, but also higher lifetime incomes, better working conditions and working environments. In Finland, researchers have calculated that a third of the difference in life expectancy between groups with different educational levels comes from smoking and alcohol-related deaths. Probably support from social networks also plays a role. The National Board of Health and Welfare states that healthcare in Sweden works better for those with a higher education (Statistiska centralbyråns, 2015d).

There are regional differences in life expectancy. It is difficult to draw generalized conclusions but all parts of northern Sweden fall below the average for the nation as a whole. Regional differences can probably be explained by differences in education but perhaps also by differences in dietary habits, employment and working conditions (Statistiska centralbyråns, 2015a).

The Life expectancy in Finland is 84 years for women and 77 years for men. The increase in life expectancy from 1977 to 2013 was 6.4 years for Finland of which 3.6 years are believed to come from a reduction in cardiovascular diseases. Other reasons for increases in life expectancy represent less than 0.6 years. For Sweden the corresponding numbers were a 4.8-year increase, where cardiovascular diseases represent 2.9 years and other causes less than 0.3% of increase (The Lancet, 2015).

The term used by MESH (MEdical Subjects Heading) to describe the oldest age group is “aged, 80 and over”. In this thesis we use the term “very old” instead of “oldest old”, which is also commonly used to describe this group (Suzman and Riley, 1985). In Sweden, where the most common age of death is above 85 for both sexes (Figure 1), the very old are often defined as those aged 85 years or more.
Transitions occur in the course of life. One way to describe these transitions is the four stages of life, which of course is a simplification but a useful description of life especially for gerontology research. The first age represent childhood and the teenage years and is characterized by dependence, socialization, education and evolving to a maturity. The second age, in mid-life, stands for independence, responsibility, maturity and earning. The third age, sometimes called the good news of old age, is the period after retirement with good health and a secure economic and social situation. The fourth age, sometimes called the bad news of old age, is a period of poor health and impaired functional abilities and dependency in the final stages of life. Distinctions between the third and fourth ages, not only focus on the positive “good news” versus negative “bad news” they could also be made from either biomedical and demographic views or sociological view in regard to functions and roles (Baltes and Smith, 2003).

The length of the fourth age, i.e. the length of the period of morbidity, is a matter that has been widely discussed because of the increasing life expectancy. There are three major theories. First, the theory of “compression of morbidity” which postulates that the years added are healthy years and morbidity is compressed into only a short period in late life. Second, the theory of “expansion of morbidity” postulates the opposite, that the years added are characterized by poor health. Third, the theory of “postponement” which postulates that the period of poor health is of equal length but just comes later in life, i.e. the added years are mainly healthy (Fries et al., 2011).

Improvement in life expectancy in previous centuries was based on a reduction in the number of deaths in childbirth, treatment of infectious diseases and improved standards of living etc. The most important reason for the increased longevity we are witnessing today is a reduction in cardiovascular diseases. One can say that previously extrinsic factors explained many deaths but now intrinsic factors are more important. Since this is so, the focus is turned on to not only physical health but also psychological health for the further improvement of longevity.

A good ageing

As previously mentioned, the increase in longevity raises the question of whether the years added to life are characterized by independence and good health or by care needs and health problems. Several studies, both international and national, focus on the matter. Two of the international studies are the Berlin ageing study in Germany (Maier and Smith, 1999) and the Leiden
study in the Netherlands (Stek et al., 2004). There are also several studies in Sweden that focus on old people, both on national level like SWEOLD (Lennartsson et al., 2014) and also regional such as the Kungsholmen study in Stockholm (Melis et al., 2014), H70 in Gothenburg (André et al., 2014) and GÅS (Good Aging in Skåne or in Swedish: Gott Åldrande i Skåne) in Skåne County (Enkvist et al., 2012), to mention a few. The Umeå 85+/GERontological Regional Database (GERDA) (GERDA botnia, 2012) is currently the most northern population-based study of its kind among old people in Sweden. The study includes people aged 85 years and older. The Umeå 85+/GERDA study has focused on many different variables important to not only for understanding and measuring factors that are threats to good ageing but also measure important factors related to health and good ageing. One such factor, related to health and good ageing, in the Umeå 85+/GERDA study is morale.

**What is morale?**

There have been many attempts to define morale. In 1962 Ross wrote: “For the present discourse, it may perhaps be acceptable to consider morale as a zestful, energetic, well-integrated positive mental attitude toward the business of living” (Ross, 1962). Lawton, who in 1972 constructed the most commonly used measure of morale the Philadelphia Geriatric Center Morale Scale, defined morale as “a generalized feeling of well-being with diverse specific indicators such as freedom from distressing symptoms, satisfaction with self, feeling of syntony2 between self and environment, and ability to strive appropriately, while still accepting the inevitable” (Lawton, 1972). Nydegger suggested in 1986 that the answers to three questions can sum up morale: (1) How does the person feel about their life? (2) How does the person feel about him/herself? and (3) How does the person feel about their relation to the world? (Nydegger, 1986). The Encyclopedia of Gerontology defines morale as follows: “A future-oriented optimism or pessimism regarding the problems and opportunities associated with living and ageing. Morale refers to how well people feel they fit into their social and physical environments and their acceptance of those things they cannot change” (Mannell and Dupuis, 1996).

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2Translation of “Syntony” into Swedish is “samklang”
**Factors comprised in morale**

Morale is believed to comprise three factors or sub-scales, often referred to as (Figure 2): Agitation, Attitude Toward Own Aging and Lonely Dissatisfaction (Lawton, 1972, Lawton, 1975, Morris and Sherwood, 1975).

![MORALE](image)

Figure 2. The concept of morale includes three ingredients

*Agitation:* Lawton defined "agitation" as "old folks’ manifest anxiety scale" with a “combination of dysphoric ideology and symptoms of anxiety" (Lawton, 1972, p 163). Lawton clearly states that agitation and morale per se do not measure disease. In the same way, pessimism is a symptom of depression but pessimism itself is not merely depression under a different name. A person with low morale is not necessarily depressed and there are depressed individuals with high morale (Wenger, 1992). Among old people a little more than one third of those with low morale and about 10% of those with high morale have depression (Benito-Leon et al., 2010).

*Lonely dissatisfaction:* “Lonely Dissatisfaction” reflects contentment or discontentment with the social interaction that the individual is receiving. Some old people experience great discomfort from the lack of social support and
contact while others feel no discontentment when alone. Possible reasons for this may lie in the current situation, previous personality traits or how the person has chosen to live their life.

*Attitude Toward Own Aging:* “Attitude Toward Own Aging” (ATOA) describes how a person accepts the inevitable changes in life, which is related to the decline in bodily functions and health that come with increasing age. Lawton defined ATOA as “ability to strive appropriately, while still accepting the inevitable” (Lawton, 1972, p 161).

**Factors known to be associated with morale**

There are several factors known to be associated with morale. However, in some areas, there have been conflicting reports and only a few studies on morale have explicitly focused on very old people.

**Age and gender**

Age and gender do not seem to be important for morale, according to some authors (von Heideken Wågert et al., 2005, von Heideken Wågert et al., 2006, Takemasa, 1998). Other researchers, however, have found at least gender differences, with women having lower morale (Wong et al., 2004, de Guzman et al., 2015).

**Health**

There have been many reports that both physical and psychological health are important to morale. In physical health both self-rated and the number of diseases are important (von Heideken Wågert et al., 2005, Wenger et al., 1995, Mancini and Quinn, 1981). Chronic illness seem to limit morale especially among very old people (Smith et al., 2002). One disease that does not seem to affect morale, however, is dementia (von Heideken Wågert et al., 2005, Nagatomo et al., 1997), but probably those with the worst cases of dementia have not been able to answer the PGCMS. Examples of diseases that affect morale are stroke events and depression (von Heideken Wågert et al., 2005, Löfgren et al., 1999, Takemasa, 1998, Woo et al., 2005). Fatigue was reported to correlate negatively with morale (Mancini and Quinn, 1981).
Old women who had lived with chronic pain had low morale levels though there were no significant relationship with morale and pain severity or pain-related disability (Cederbom et al., 2014).

Social factors

Feeling lonely (von Heideken Wågert et al., 2005, Wenger et al., 1995), number of hours spent alone each day as well as having friends and family support, i.e. social network, are important to morale (Loke et al., 2011, Ward et al., 1984, Wenger et al., 1995). However, marital status did not seem to be of importance (Lawton, 1972, Wenger et al., 1995). Ordinary housing (as opposed to living in a caring institution) and feeling safe were reported to be important for morale (von Heideken Wågert et al., 2005).

Functional factors

In- and out-door mobility and independence in ADL were reported as important for morale (von Heideken Wågert et al., 2005, Loke et al., 2011, Smith et al., 2002, Takemasa, 1998, Wenger et al., 1995), however, ADL (as measured with Katz Index) was not associated with morale in another study (Nagatomo et al., 1997). Hearing and reading impairments did not seem to be associated with morale but distance vision impairment did (von Heideken Wågert et al., 2005). An association between morale and vision impairment has also been reported by others (Mancini and Quinn, 1981, Smith et al., 2002) and association between morale and hearing impairment have been reported (Smith et al., 2002).

Economic status

There was an association with income, i.e. socio-economic status, and with morale, where higher income led to a higher morale (Wenger et al., 1995, Mancini and Orthner, 1980).
Hobbies/Leisure activities

There was a positive correlation between morale and satisfaction with leisure (Mancini and Orthner, 1980).

Religion

Religion has been shown to have an association with morale in the life of many older individuals (Loke et al., 2011, Sullivan, 1997). With higher religiosity came improved Attitude Toward Own Aging and less Loneliness Dissatisfaction, but made no difference in Agitation.

Personality

Personality traits known to correlate with morale are extraversion and emotional stability (Loke et al., 2011, Martin et al., 1992).

Culture and morale

There are cultural differences around the world; for instance the western world puts the emphasis on the individual advocating self-realization, while Asian populations are more collectivistic, advocating harmonic family relationships (Nydegger, 1986). One support for the belief that morale is a viable phenomenal construct even in non-western cultures is that the validity and reliability of the PGCMS have also been tested previously in non-western cultures (Liang et al., 1987a, Liang et al., 1987b, Liang et al., 1992, Pinar and Oz, 2011, Stock et al., 1994, Wong et al., 2004).

Related and similar concepts

There are a number of similar and partly overlapping concepts describing well-being. One perspective that can help in understanding some of the concepts is the relation to time for life satisfaction, happiness and morale (Figure 3).
Figure 3. Life satisfaction, happiness and morale on a time scale showing slight overlap.

Life satisfaction is seen as a cognitive reflection or judgment of one’s expectations of life so far and from the perspective of time is therefore placed more in the past. Happiness is experienced in the present and morale concerns attitudes toward the future and attainable goals (Mannell and Dupuis, 1996). Some overlap is likely, as shown in Figure 3. Indeed, some of the questions partly overlap in the PGCMS, which is used to measure morale, and the Life Satisfaction Index, which is used to measure life satisfaction. Questions in the PGCMS ask the person to reflect over the past and one question in the Life Satisfaction Index A (Neugarten et al., 1961), asks if the person has plans for the future.

Happiness is often thought of as two doctrines, resulting from the theoretical thinking of Greek philosophers: hedonism and eudaimonia. Hedonism as articulated by the Greek Aristippos (435-366 BC) is based on the idea that the meaning of life is to maximize the experience of pleasure and minimize that of pain; the presence of positive affect and absence of negative affect. Hedonism could be summed up in the words “Don’t worry – be happy” (or in Swedish “Det ska va gött å leva”). In contrast to hedonism, Aristotle (384-322 BC) presented the theory of eudaimonia, which literally means to “be true to your inner self” (“demon” meaning “inner self”). The essence of eudaimonia is to identify one’s true potential, i.e. striving toward excellence, in a deeply satisfying way. In other words, Eudaimonia means to develop one’s strength for a higher purpose or to help other people. Eudaimonia can be summed up in the words “Be all that you can be” or “Make a difference” (Peterson et al., 2005, Ryff and Singer, 2008). Some recent researchers have added “flow” to the doctrines of happiness. Flow is the state you are in when you focus all your attention on a highly engaging activity and time often passes quickly, regardless of how meaningful the activity is (Peterson et al., 2005).
Mental health often, referred to as subjective or psychological wellbeing, is a construct of positive and negative affect. Wellbeing has both cognitive and emotional aspects. Cognitive appraisal is based on comparison of one’s current situation with expectations and goals, whereas affective appraisal is based on negative and positive emotions. Affect refers to both the positive and negative feelings or moods a person can experience, but not cognitive reflections. There is much debate about whether positive and negative affects are on the same continuum or are separate dimensions of parallel feeling. Positive affect refers to feelings of interest, energy and zest for life, pride or delight and active engagement, whereas absence of positive affect is indicated by tiredness or fatigue. Negative affect refers to feelings of guilt, anger, sadness, fear, being upset or worried, whereas absence of negative affect is referred to as being relaxed or calm. Wellbeing assessment scales cover both positive and negative affect (McDowell, 2006). Some of the questions in the PGCMS, and the similar Life Satisfaction Index, concern different affect. Both scales may be influenced by affect but are not merely measures of emotions and they have elements of cognitive reflections.

More than 100 definitions of quality of life and more than 1000 different instruments that attempt to measure all or parts of it was found in making of a review article from 2007 (Halvorsrud and Kalfoss, 2007). Consensus will therefore be difficult. One definition of quality of life is that it is ”a judgment about the level of desirability of this life”. Probably it is like with food, everyone has to eat, but we like different dishes (Boggatz, 2015). When the Royal College of Physicians in London and the British Geriatric Society reviewed a number of quality of life scales, they recommended the use of the Philadelphia Geriatric Center Morale Scale (PGCMS) for measuring subjective wellbeing among old people (Royal College of Physicians of London, 1992). Morale correlates with and is often used synonymously with quality of life, subjective and psychological well-being (Andrews et al., 2002, de Guzman et al., 2015, Ranzijn and Lusczcz, 2000, Ryff and Essex, 1992, Shmotkin and Hadari, 1996, Tovel and Carmel, 2014).

Morale can also be considered as an inner force that helps to resist difficulties in life in a salutogenic way. Several concepts have been suggested that capture a similar essence e.g. inner strength, resilience, sense of coherence, purpose in life, hardiness, etc. In one study these later concepts was defined in relation to one another (Lundman et al., 2010), however, it did not clarify the relation between morale and theses concepts.
Changes over time

There are theories and data concerning what happens to wellbeing across different ages and when death becomes increasingly imminent. Data show that wellbeing increases up to about 65 years of age and then declines (Figure 4) (Mroczek and Spiro, 2005). Other researchers argue that wellbeing is stable in adult life until late in life, approximately at the age of 70-90 years, and the declines (Baird et al., 2010, Gerstorf et al., 2010). There are also authors who disagree to this theory (Kunzmann et al., 2000) and believe it is not age per se that causes the decline rather age-related losses.

There are both gains and losses in the natural ageing process. Since morale is a multidimensional concept, it can potentially be both strengthened and weakened by increasing age. To my knowledge there are no studies focusing specifically on the change of morale over time for very old people. However, there is one study that examined old peoples’ morale longitudinally over twelve year, with a mean age of 71.0 years (range 65 to 88 years) at start and a mean age was 82.2 years (range 76 to 99 years) at the end, where the PGCMS score declined from 13.2±3.3 to 12.3±3.3 with a p<0.01 (Scott and Butler, 1997).

Some researchers have attempted to understand what happens to wellbeing when death approaches for old people. Data from one such study indicate a
decline in wellbeing one year before death (Figure 5) (Mroczek and Spiro, 2005). Other researchers have observed a tendency of this kind from three up to five years before death occurs (Gerstorf et al., 2014, Palgi et al., 2010, Rapp et al., 2008, Gerstorf et al., 2008).

Figure 5. What happens to wellbeing when the end of life is getting close (with permission to reprint), Mroczek and Spiro, 2005.

As we get older, there is a risk that wellbeing, and morale, will decline. The ability to adapt after potential losses associated with old age is well known and often referred to in laymen terms as “time heals everything” or in research terms the “Hedonic treadmill”\(^3\) (Mroczek and Spiro, 2005). Humans have different mechanisms for trying to compensate for the loss. First, there is the theory of adaptive development: selective optimization with compensation (SOC). Selection, for example, is prioritizing fewer goals and concentrating on areas that still work, which leads to more time and energy to achieve the desired outcomes. Optimizing means finding more efficient solutions and appropriate uses of available resources. Compensation means us-

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\(^3\) The “Hedonic treadmill” also takes into account whether your happiness is improved, for instance, by winning a huge amount of money on a lottery ticket, in which case you would probably adapt to your previous level of wellbeing eventually.
ing different methods, complementary activities or aids to maintain previous levels of functioning (Baltes and Smith, 2003). Another example, or another way of describing the compensation mechanism, is the use of coping strategies. The most common coping strategies among old people are assimilative coping, where the individual adjusts the circumstances to expectations, and accommodative coping, where the individual adjusts expectations to circumstances (Paul et al., 2007).

The opposite is also possible when a person uses maladaptive coping mechanisms. Lawton, who developed the PGCMS, mentioned the problem of denial, which is considered a maladaptive coping mechanism, when measuring morale in an individual (Lawton, 1972). If a person does not admit there are problems and just sees the positive, there is a possibility that the assessment will not be accurate.

Second, yet another way in which old people can experience high levels of wellbeing despite of decline in bodily functions are through gerotranscendence, sometimes referred to as “socio-emotional selectivity theory”. Gerotranscendence occurs when life wisdom and maturity redefine what is important in life; a reduced need for social contact in the present and an increased need for spiritual contact with the universe. Gerotranscendence also focuses less on concern about health problems and more on enjoying the small things in life, which leads to inner peace (Tornstam, 1989).

Third, there are individuals who suffer losses due to disease and functional impairment but still seem to have a good quality of life. Part of this good quality of life can be explained by coping mechanisms and part can be explained by gerotranscendence but some of it cannot be explained. For reasons we do not understand some people manage to keep a good quality of life despite experiencing severe adverse life events. This is called the “disability paradox” or the “stability-despite-loss paradox” (stability in this case refers to the ability to maintain their previous level of well-being)(Paul et al., 2007).

**How to measure morale - The psychometrics of the PGCMS**

When Lawton first constructed the PGCMS it had 22 items and was thought to measure six factors: Surgency, Acceptance of Status Que, Easygoing Optimism, Agitation, Attitude Toward Own Aging and Lonely Dissatisfaction (Lawton, 1972). Shortly after the creation of PGCMS, however, the first three factors were found to be unstable or impossible to replicate and were there-
fore omitted, along with five items (Lawton, 1975, Morris and Sherwood, 1975).

The internal consistency of the PGCMS was tested by Lawton and was found to be 0.81 according to the Kuder-Richardson’s test (Lawton, 1972). Lawton also found that the three factors Agitation, Attitude Toward Own Aging and Lonely Dissatisfaction had a high level of internal consistency with Cronbach’s alpha estimates of 0.85, 0.81 and 0.85 respectively (Lawton, 1975). A Rasch analysis of the PGCMS showed that the overall item logit positions were stable across time (Ma et al., 2010).

Liang and Bollen examined the factorial structure of the PGCMS in several publications. They found no substantial age, gender or race difference in factorial structure (Liang and Bollen, 1985), i.e. the PGCMS seems equally valid for both women and men, different age groups and different races.

Convergent-divergent validation tests found that the PGCMS correlated 0.57 with the Life Satisfaction Index (LSI) (Lawton, 1972), 0.74 with the Life Satisfaction Index Z (LSIZ) (Kozma and Stones, 1987) and 0.79 with the 36-item Short Form Health Survey Mental Component Summary (SF-36 MCS) (Pinar and Oz, 2011). The 15-item Geriatric Depression Scale (GDS-15) had a reverse correlation of -0.66 with PGCMS, regardless of the Mini Mental State Examination (MMSE) score (Conradsson et al., 2013). There was also a reverse correlation of -0.68 with the Beck Hopelessness Scale [7].

The PGCMS is easy to administer with 17 questions with dichotomized answers, such as “yes” or “no”. With dichotomized answer alternatives the PGCMS seems to be suitable for use with frail old people in whom impaired cognitive capacity is common (Ryden and Knopman, 1989), however, the feasibility of the PGCMS among very old people has not previously been tested. Despite its frequent use, the psychometric properties of the Swedish version of the PGCMS have not been evaluated.

**Stroke**

Stroke is a major health problem and the incidence increases with age. The World Health Organization (WHO) estimates that approximately 10% of people aged 85 years and above have had a stroke in most Western European countries (Truelsen et al., 2006). One Swedish study showed a stroke prevalence of 18.8% among 85-year-olds, using multiple information sources: self-
reporting, key informant, focal neurological signs and medical records (Liebetrau et al., 2003).

Stroke is a disease that in many cases leads to a sudden deterioration in the quality of life. There is general agreement that the effects of stroke treatment should be measured in terms of quality as well as length of survival (Carod-Artal and Egido, 2009, Buck et al., 2000). There are a number of different assessment scales for quality of life. The PGCMS is not specifically designed for use in people who have had a stroke but it is applicable in individuals with a stroke history (Löfgren et al., 1999). Stroke is known to reduce morale among younger old people (mean± SD 75.5±8.2) (Löfgren et al., 1999). Other studies using similar measurements for quality of life, other than morale, have found a decline due to a stroke event (Åström et al., 1992, Clarke et al., 2002, Sturm et al., 2004, Wyller et al., 1998).

**Depression**

Depression constitutes a high disease burden in the general population, especially in middle- and high-income countries (World Health Organization, 2008). Depression among very old people differs from depression in the younger old regarding for instance risk factors (Mast et al., 2005, Stek et al., 2004) and symptoms (Mehta et al., 2008, Rodda et al., 2011). Depression is also common among very old people with a reported prevalence ranging from 15 to 32 % (Paivarinta et al., 1999, Petersson et al., 2014, Stek et al., 2004). In recent years research has also shown an increase in the prevalence of depression in very old people (Parker et al., 2005). Depression in elderly people is often underdiagnosed (Collerton et al., 2009, Stek et al., 2004) and undertreated (Bergdahl et al., 2005). It is also unclear whether treatment of depression is effective in this age group (Bergdahl et al., 2005, Stek et al., 2004). Depression in the elderly also brings with it an increased risk of hospital admission and longer stays in hospitals (Prina et al., 2013) as well as increased healthcare costs (Katon et al., 2003). Depression in very old people is related to reduced quality of life and increased mortality (Bergdahl et al., 2005, Van der Weele et al., 2009).

The incidence of depression over time among very old people could be reduced by protective and salutogenic factors, such as dispositional optimism (Giltay et al., 2006b). It is important to find health-promoting factors, especially for very old people who constitute a rapidly increasing section of the population in many western countries (Eurostat, 2012) and who in late life
are at risk of a decline in health. One such possible saultogenic factor might be high level of morale.

**Survival**

Low morale has been associated with increased mortality in a younger old sample (75.7±6.1 years) (Benito-Leon et al., 2010). It has been suggested that a number of wellbeing concepts, such as life satisfaction, happiness and positive life orientation, are associated with longevity (Chida and Steptoe, 2008, Collins et al., 2009, Koopmans et al., 2010, Lyyra et al., 2006, Sadler et al., 2011, Tilvis et al., 2012). Individuals with a more positive self-perception of ageing, assessed using one of the three sub-scales of the PGCMS, were found to live longer than those with less positive self-perception (Levy et al., 2002, Maier and Smith, 1999). Compared to the younger old, the biological decline among the very old, often frail, elderly is more pronounced and it is not known if morale could influence their survival.

Frailty is a concept that describes vulnerability to a negative outcome, also depleted reserves with a reduced ability to maintain or regain homeostasis, i.e. reduced resilience. The risk of frailty increases with age and the number of diseases. A frequently used definition is Linda Fried’s five criteria: unintentional weight loss, exhaustion, muscle weakness, slowness while walking, and low levels of activity (Fried et al., 2001). Frailty is important to survival among very old people. Rockwood and Mitnitski had another approach to defining frailty. They viewed it through the number of health "deficits" an individual manifests (Rockwood et al., 2007, Rockwood and Mitnitski, 2007).

**How morale can be used in research**

**Morale as an outcome measure**

Morale is often used as a measure of quality of life and therefore used as an out-come measure (Conradsson et al., 2010, Royal College of Physicians of London, 1992, Valentine et al., 2011). This assumes that the PGCMS is capa-

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4 An outcome variable is thought to change as the result of an action of some other measurable force.
ble of measuring the change over time. There is probably at least some sta-
bility in morale over time and it also seems likely that a permanent decline 
would emerge from the impact of an adverse event with a vital impact on the 
individual. One such adverse life event is to suffer a stroke (Löfgren et al., 
1999) however, it has not specifically been studied among very old people.

**Morale as explanatory variable**

A new perspective is whether morale can be used as an explanatory vari-
able. There has been much research into factors affecting morale, but not 
much about the other way. There are only two studies, to my knowledge, that 
examines the effects of low morale either on five-year mortality or (Benito-
Leon et al., 2010) as a predictor of the risk of falling within 8 years (Anstey et 

al., 2008). We wanted to explore whether there is a relation between morale 
and the five-year incidence of depressive disorders and we also wanted to 
explore whether there is a relation between morale and longevity specifically 
among very old people.

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5 An explanatory variable presumes that the variable causes an effect on something else.
Rationale for this thesis

The purpose of the Umeå 85+/GERDA study is to investigate factors associated with and threats to good ageing among very old people. The very old constitute the fastest growing age group in the western world. It is difficult to carry out research on this age group because many are weak and vulnerable due to age-related decline and disease. Morale has been studied among old people, but only a few studies specifically focus on very old people.

Assessment scales used in geriatric clinical practice mainly focus on finding disease, e.g. depression or cognition assessment. There is a demand in both geriatric research and in health and nursing care for simple, validated assessments scales to measure quality of life. Such assessments scales have to be designed so that they are useful among old and very old individuals. The Philadelphia Geriatric Center Morale Scale correlates with quality of life measures, however, the psychometric properties of the Swedish version have never been tested and the scale has never been specifically tested on very old people.

Stroke is a common health problem among very old people. There is a debate on the exact prevalence figures among people aged 85 years or above but recent research suggests it can be as high as 18% (Liebetrau et al., 2003). There is general agreement that the effects of stroke treatment should be measured in terms of quality as well as length of survival (Buck et al., 2000, Carod-Artal and Egido, 2009). What factors are associated with morale among those who have had stroke has not been fully explored.

There is extensive research on factors affecting morale rather than vice versa. Many studies have also focused on low morale rather than the possibly health-promoting power of high morale. It is important to find and evaluate salutogenic factors, such as high morale, among very old people.

Depression is a disease with a high prevalence among very old people; 15-32% are thought to have a depressive disorder. It is known that morale is associated with depression from cross-sectional studies but it is not known whether high morale can protect against depression, i.e. whether high morale has salutogenic properties.

For natural reasons mortality is high among very old, often frail people. It is not known whether high morale can have a positive effect on five-year survival even among very old people.
AIMS

The overall aim of this thesis was to explore morale among very old people. The specific aims of the papers were:

PAPER 1 - To evaluate the psychometric properties of the Swedish version of the PGCMS and test its feasibility.

PAPER 2 – To investigate the prevalence of stroke in a representative sample of people aged 85 years or older in Northern Sweden and Western Finland and to evaluate factors associated with morale among those who have had a stroke compared to those who have no history of stroke.

PAPER 3 - To investigate if higher morale at baseline is associated with a lower risk of having a depressive disorder five years later.

PAPER 4- To investigate whether high morale is associated with increased five-year survival of very old people.
Method

Participants

Two samples were used in this thesis, the Umeå 85+/GErontological Regional DAtabase-study (GERDA) study (Figure 6) and a convenience sample study.

![Diagram of participants](image)

Figure 6. Overview of participants in this thesis from the Umeå 85+/GERDA sample. Parts in grey shade were not used in this thesis.

The first and main sample used in this thesis is taken from the Umeå 85+/GERDA study, which is a population-based interview study carried out in northern Sweden and western Finland. Population registers were obtained from the National Tax Board in Sweden and the Finnish Population Register Centre. To obtain three groups of equal size, every other 85-year-old, every 90-year-old and all those aged 95 years or more were invited to participate. It was randomly determined if persons with odd or even position in the population register should be included among the 85-year-olds. The interviewers began with the oldest individuals to minimize the risk of a participant dying.
before contact. Age and where the person was living were the only inclusion criteria.

The study started in the years 2000-2002 and included new participants every five years, when participants from previous data collections were also followed up. In the years 2000-2002 the study recruited participants from six municipalities in northern Sweden, one urban (Umeå in the year 2000) and five rural (Sortsele, Storuman, Malå, Vilhelmina, Dorotea in the year 2002). This data collection is entitled “Swe 1” in Figure 6. Five years later, in the years 2005-2007, living participants were followed up, also called “Swe 1” in Figure 6, and new participants were recruited, labelled “Swe 2”. The study was expanded to include two municipalities in Finland, one urban (Vasa/Vaasa) and one semi-rural (Korsholm/Mustasaari), called “Fin 1” in Figure 6. The Finnish municipalities that were included in the Umeå 85+/GERDA study have both Finnish- and Swedish-speaking inhabitants. Municipalities in Finland are culturally and socioeconomically fairly similar to municipalities in Sweden.

Five years later, in the years 2010-2012, participants still living were followed up, called “Swe 1”, “Swe 2” and “Fin 1” in Figure 6. However, none of those still alive in “Swe 1” from the years 2000-2002 were used in any study in this thesis. In year 2010-2012 new participants were recruited “Swe 3” and “Fin 2”, however, they were not included in this thesis. The latter two groups are therefore in grey shade in Figure 6.

The second sample, a convenience sample, was collected during 2013 to assess the intra-rater test-retest reliability of the PGCMS, with re-assessments within one week. Participants were recruited from the community and institutional care facilities in three municipalities in northern Sweden (Umeå, Luleå and Lycksele). The only criteria for participation were being at least 75 years old and having the cognitive capacity to give written, informed consent.
**Paper I – Psychometrics**

To test the psychometric properties of the Swedish version of the PGCMS, this study included Swedish-speaking participants in the Umeå 85+/GERDA study during the years 2000-2007, the first time they answered the PGCMS and the MMSE. Most participants were collected from “Swe 1”, “Swe 2” and the Swedish-speaking part of “Fin1” (Figure 7). However, there were a few participants (n=20) in “Swe1” who for various reasons, such as inadequate strength on the day of the interview, did not answer the PGCMS the first time (“Swe 1” 2000-2002) but answered the PGCMS in the five-year follow-up (“Swe 1” 2005-2007).

Figure 7. Participants in Paper I from the Umeå 85+/GERDA study

Note: Only Swedish-speaking participants from ”Fin 1” were included. A few participants from ”Swe 1” 2005-2007 were also included in Paper I
The Umeå 85+/GERDA sample comprised 723 individuals of whom 722 answered the Mini Mental State Examination (MMSE) and 598 answered the PGCMS. Of the 598 there were 493 who answered all 17 PGCMS items (Figure 8).

![Flowchart of the Umeå 85+/GERDA sample used in paper I](image)

In the second sample used in Paper I, the convenience sample, 61 individuals were assessed using the PGCMS, but only 54 answered all 17 items twice within one week. These 54 individuals constitute the convenience sample.
**Paper II – Stroke and morale**

The sample used in Paper II is a cross-sectional sample which includes all the individuals interviewed in the years 2005-2007, i.e. “Swe 1”, “Swe 2” and “Fin 1” from the years 2005-2007 (Figure 9).

![Figure 9. Participants from the Umeå 85+/GERDA study used in Paper II](image)

A total of 962 individuals (range 85-107 years) were selected and invited to participate (612 Swedes and 350 Finns), however, 74 died before contact could be made (43 Swedes and 31 Finns) and 180 declined participation (101 Swedes and 79 Finns). Of the 708 individuals who participated 468 were Swedes (327 women and 141 men) and 240 Finns (177 women and 63 men). There were 243 individuals who did not answer the PGCMS. Of the 465 who answered the PGCMS, 91 had had a stroke (Figure 10).
Non-participation analysis shows that there were no differences between participants and non-participants regarding age (participants mean age 90.3 years and non-participants 89.6 years, p-value 0.090) or sex (p-value 0.053).
Paper III – High morale and depression

The sample used in Paper III were included in year 2000-2002, “Swe 1”, and in 2005-2007, “Swe 2” and “Fin 1” (Figure 11). The participants were followed up five years later, and their data concerning the presence or absence of depressive disorders at the five-year follow-up were used.

![Figure 11. Participants from the Umeå 85+/GERDA study used in Paper III](image)

There were in total 1310 individuals eligible for recruitment to baseline data collection in 2000 to 2002 and 2005 to 2007. Of these, 116 died before contact could be made and 222 refused to participate. A total of 972 individuals accepted participation of whom 135 declined a home visit. Of the 837 who agreed to a home visit, 176 were without a baseline Philadelphia Geriatric Morale Scale (PGCMS) score. A baseline PGCMS score was obtained for 661 individuals, 92.3% (610/661) answered 16 or all 17 PGCMS items. Fourteen individuals who answered fewer than 12 PGCMS items were excluded. The baseline sample included 647 individuals with a baseline PGCMS score on 12 or more answered items (Figure 12).
Missing PGCMS-data analysis

There were no significant differences regarding age or gender between those who agreed and those who did not agree to a home visit. Those who agreed to a home visit but did not answer the PGCMS, or answered fewer than 12 items, were compared to those who agreed to a home visit and who were able to answer 12 or more PGCMS items. The former were generally older, 91.5±4.8 versus 89.1±4.4 years (p<0.001) and more often women 79.5% (151/190) versus 67.4% (436/647) (p=0.002). They had more often had depressive disorders, 41.7% (78/187) versus 29.7% (192/647) (p=0.003), and had lower MMSE scores 10.3±9.1 versus 23.4±5.0 (p<0.001).
**Paper IV – High morale and five-year survival**

In Paper IV the data from the 2000-2002 collection, “Swe 1”, and all new participants from 2005-2007, “Swe 2” and “Fin 1”, were included (Figure 13). In this study, mortality data from the same period were also used, so that each participant either survived or had mortality data up to five year after inclusion.

Information about dates of death during the five years of follow-up was acquired from either the Swedish National Board of Health and Welfare or the Finnish National Population Information System.

![Figure 13. Participants from the Umeå 85+/GERDA study used in Paper IV](image_url)
There were 1489 individuals eligible to participate from the Umeå 85+/GERDA study, of whom 118 died before contact and 230 declined participation. There were also 115 individuals who participated in the data collection in both 2000-2002 and 2005-2007. Only data from their second participation, i.e. when they were five years older, were used, in order to include as many as possible of the oldest individuals. Of the 1026 individuals who participated once, 176 declined a home visit and were excluded. Of the 850 who accepted a home visit, 204 were excluded because they answered no PGCMS questions (n=196) or fewer than twelve (n=8). The final sample comprised of 646 individuals (Figure 14).

Figure 14. Flowchart of the Umeå 85+/GERDA sample used in paper IV
Missing PGCMS-data analysis

No note was made of why PGCMS questions were not answered. However, the 204 individuals who answered no PGCMS questions or fewer than twelve were generally older, with a mean age of 91.6±4.9 vs. 89.1±4.4 years (p<0.0001), the proportion of women was higher 79.4% (162/204) vs. 67.3% (435/646) (p=0.001) and they had a higher proportion of dementia disorders 61.3% (125/204) vs. 18.4% (119/646) (p<0.0001) than those 646 who answered 12 or more of the PGCMS questions. The 204 individuals also had low survival rates, only 15.2% (31/204) were alive after five years.

Additional analysis

The PGCMS was assessed in the Umeå 85+/GERDA project in the years 2000-2002, and 301 participants were tested. Some of those individuals (n=120) were re-assessed within the following year by other interviewers (Figure 15).

Figure 15. Re-assessing of PGCMS in parts of the Umeå 85+/GERDA sample for inter-rater testing analysis.
**Procedure**

The potential participants from the Umeå 85+/ GERDA study were sent a letter that contained information about the study and were later contacted by telephone to obtain their informed consent to participation. There were no exclusion criteria. If there were doubts concerning their ability to give their consent due to cognitive impairment, participation was discussed with their next of kin. Specially trained physicians, physiotherapists, nurses or medical students interviewed the participants in their own homes. The interview, which lasted approximately two hours, comprised predefined questions and assessment scales. Individuals with severe diseases, such as dementia or aphasia, were included in the study partially, which explains why some of the participants were unable to answer some of the interview questions or items on the assessment scales. After the interview, medical records were reviewed and, when the interview was incomplete, relatives and caregivers were interviewed.

The convenience sample comprised old people living either in the community or in residential care facilities. In the latter the doctors and nurses in charge were contacted to help select suitable persons to ask to participate. A number of community-dwelling senior citizens were also asked to participate. The only criteria for being invited to participate were being at least 75 years old, willing to participate and having the mental capacity to give informed consent. If they agreed to participate, they were interviewed and re-interviewed within seven days by the same assessor (3.9±1.9 days±SD between assessments). The participants were interviewed in their own homes by trained researchers experienced in communicating with the elderly. Either a physician or a nurse performed the interviews. Each interview comprised a predefined set of questions (age, sex, marital status and type of housing) and assessment scales, such as the PGCMS and Geriatric Depression Scale, with four questions (GDS-4), and usually lasted less than thirty minutes. The second visit lasted 10 minutes and only the PGCMS and GDS4 were administered.

**Assessment scales, Diagnoses and Measures**

The Philadelphia Geriatric Center Morale Scale

The PGCMS has 17 “yes” or “no” questions that are so constructed as to be easy to answer and the higher the number of points the better the morale. For some items, the answer giving one point is “yes” and for other items
“no”. Lawton considered scores between 0 and 9 points to indicate low morale, 10 to 12 intermediate and 13 to 17 high morale. Unanswered questions occurred in our study, despite verbatim repetition of the question and adequate hearing, and were listed as zero points, according to the scoring instructions (Lawton, 2003). If none of the questions was answered, for instance for cognitive or aphasic reasons, this was considered as a missing value.

In Papers I and II, all PGCMS assessments with answered items were used, but in Papers III and IV twelve or more answered questions was regarded as the minimum for inclusion. Preferably the respondent should answer 16 to 17 items (which approximately 92% of the participants did), since the validity is tested on all or only one unanswered question, but including those answering between 12 and 15 questions increases the sample without too much loss of validity. The 12-item limit was chosen so that at least two-thirds of the questions were answered.

In Lawton’s version, most questions have yes or no answers but some have other answers: not much or a lot, better or worse and satisfied or not satisfied (Appendix). A PGCMS version for British English was developed by Challis and Knapp in 1980 and some items were slightly rephrased so that there are only “yes” or “no” alternative answers in the scale and all items were rephrased to form questions instead of statements (Challis and Knapp, 1980). The position of item 4 and 5 were reversed because this believed to more logical (David Challis, personal communication, August 26, 2014). The 17-item British English, or anglicized, version of the PGCMS, was translated into Swedish by native Swedish speakers. A translation back into English was carried out by a bilingual person who had read neither Lawton’s original version nor the anglicized version. Unclear and incorrect translations were discussed to establish the accurate meaning of the respective items and to ensure closer equivalence between the item and its related dimension. This process followed the recommended guidelines for translating assessment scales (Guillemin et al., 1993).

The positions of items 4 and 5 are reversed in the Swedish version compared to Lawton’s 17-item version, following the order in the British English version. When testing the psychometric properties in this thesis, these two items were handled according to their position in Lawton’s 17-item PGCMS version (Paper I) since previous psychometric testing has used Lawton’s positions of these two questions. See Appendix for the Swedish, British English and American English versions of the PGCMS.
There is another version in the scoring system, not used very much, where high morale response to each question is given three points, low morale response is given one point and the alternative “don’t know” is given two points. The score is then divided by 17 and an average score of 2.5 is considered to indicate higher morale, scores varying between 2.1 and 2.5 to indicate moderate morale and scores below 2.1 low morale (Wenger et al., 1995, Shahtahmasebi, 2004). This scoring system is not used in the present thesis.

There is a variant of the PGCMS where a proxy answers the questions instead of the individual, i.e. giving an “objective” rather than “subjective” assessment. This variant is called PGCMS Observer Rating Form (Ryden and Knopman, 1989). This version is not used very much and is not used in the present thesis.

The Geriatric Depression Scale

Depression was screened for using the GDS-15 (Sheikh and Yesavage, 1986) in the Umeå 85+/GERDA sample and GDS-4 (D’Ath et al., 1994) in the convenience sample. GDS 15 is a useful tool in screening for depressive symptoms among old people and has been shown to have high sensitivity and specificity for detecting depression. The scale consists of 15 “yes” or “no” questions. Scores between 5 and 9 are considered to indicate mild depression and those between 10 and 15 moderate to severe depression (de Craen et al., 2003). The GDS 4, together with four out of the 15 items in the GDS 15, has been found to have a sensitivity and specificity comparable to the GDS 30 (Goring et al., 2004, Pomeroy et al., 2001) and appears useful as a screening instrument for depression. Scores between 1 and 4 is considered to indicate depression (Pomeroy et al., 2001).

The Organic Brain Syndrome Scale

The Organic Brain Syndrome Scale (OBS) (Björkelund et al., 2006, Jensen et al., 1993) was developed to assess symptoms that appear in cases of delirium, dementia and other brain disorders. In the Umeå 85+/GERDA study only the second part, OBS2, was used which is based on observations from the preceding month from participants, caregivers and relatives concerning a wide spectrum of psychopathology such as suspiciousness, emotional reactions, delusions, hallucinations, disturbances in speech, spatial orientation, recognition, physical and practical abilities and variations in the person’s
clinical state. In the Umeå 85+/GERDA study, only the second part, OBS2, was used and this part is based on observation from the last month from participants, caregivers and relatives concerning a wide spectrum of psychopathology such as suspiciousness, emotional reactions, delusions, hallucinations as well as disturbances in speech, spatial orientation, recognition, physical and practical abilities and variations in the person’s clinical state. In this thesis, the information gathered with the OBS scale was only used to help assess depressive disorder.

The Montgomery-Åsberg Depression Rating Scale

The Umeå 85+/GERDA study uses the 30-point version of the Montgomery-Åsberg Depression Rating Scale (MADRS) (Montgomery and Åsberg, 1979) to assess level of depressive symptoms and is only used when the examiner is a physician or specially trained medical student. The scale is designed to assess severity of depression and is commonly used to evaluate the effects of antidepressant treatment.

The Mini-Mental State Examination

The Mini-Mental State Examination (MMSE) is used for cognitive assessment. This scale was developed as a screening test to quantitatively assess and document cognitive decline over time. Scores can range from 0 and 30 and the higher the score the better the cognition (Folstein et al., 1975). A MMSE score of ≤17 indicates severe cognitive impairment and 18-23 indicates mild cognitive impairment (Tombaugh and McIntyre, 1992).

The Barthel ADL index

Activities of daily living (ADL) were assessed using the Barthel ADL index. The scale has a maximum score of 20, indicating total independence in personal ADL (Mahoney and Barthel, 1965).
The Mini Nutritional Assessment

Nutritional status was assessed using the Mini Nutritional Assessment (MNA), an instrument developed to screen the nutritional status of old people. The maximum score of 30 indicates normal nutritional status; a score of between 23.5 and 17 indicates a risk of malnutrition; values below 17 were considered to indicate the presence of malnutrition (Guigoz et al., 1994).

Medical diagnoses

All medical diagnoses were determined according to the same criteria in both Sweden and Finland by one experienced specialist in Geriatric Medicine after reviewing information from interviews, assessment scales, medication and medical records from hospitals, general practitioners and caring institutions.

Stroke was defined according to the WHO definition as rapidly developing clinical signs of focal (or global) disturbance of cerebral function, lasting >24h or leading to death, with no apparent non-vascular cause (World Health Organization, 1988). The stroke diagnosis was based on information from self-reported stroke diagnosis, from key informants i.e. relatives or caregivers, and clues gathered from medication and obvious neurological deficits. This information was later validated in the medical records. An ischemia or haemorrhage of the brain regardless of severity or when in life it occurred, was noted as a stroke in this study.

Depressive disorders, delirium and dementia were diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders fourth edition (DSM-IV) criteria (American Psychiatric Association, 1994). In this thesis, participants with minor depression, dysthymia, depression due to general medical conditions and due to side effects of medication were also considered to have depression in this study. If a person already had a diagnosis of depression they were considered to have depression either when scales such as the GDS-15, OBS scale or MADRS scale showed signs of ongoing symptoms or if the participant received ongoing treatment for depression regardless of the result from any scale.

Information about dates of death during the 5 years of follow-up was acquired either from the Swedish National Board of Health and Welfare or the Finnish National Population Information System.
Other variables used

*Housing* was classified as ordinary if the participant lived in a house or apartment with or without access to home care. Institutional care included residential care facilities, nursing homes and group dwellings for people with dementia. Participants were considered to be living alone if they did not live with a partner or other close relative. In Swedish, and in most Finnish, institutional care facilities, rooms and apartments are almost never shared, thus participants were classified as living alone even in institutional care.

*Social contact* was considered as the number of contacts per week, either in the form of having visitors or visiting someone but did not include visits by home-care services or the like. If visits occurred less often than once a week, it was dichotomized as “social contact less than once a week” in Papers II and IV. Social isolation in Paper III was considered present if the participant’s number of visits per week, either having visitors or visiting someone, was one or fewer.

*Perceived social isolation* was dichotomized and considered present if the participants felt that they “seldom” or “never” had visitors or visited anyone and not experiencing perceived social isolation was based on scoring the item “often” or “sometimes”.

*Feeling lonely* was dichotomized and considered present if the alternative responses “often” and “sometimes” as opposed to “seldom” and “rarely” were given for the item. Feeling unsafe was based on the question “Do you feel safe?” with alternatives answers “yes” or “no”.

*Impaired vision* was defined as unable to read words written in four-millimetre capital letters, with or without spectacles, at normal reading distance.

*Impaired hearing* was defined as not being able to hear normal conversation at a distance of one meter, with or without hearing aids.

*Economical insufficiency* was based on the question “Do you have financial difficulties?” and was categorized as sufficient if answer was “no financial difficulties” and insufficient if answered with “some”, “quite” or “great” difficulties with financial situation. This question was only available from 2005 and later in the Umeå 85+/GERDA study.

*Education* in Paper II was dichotomized between 0-7 and >7 years due to previous work from the Umeå 85+/GERDA study. In Papers I and IV educa-
tion was dichotomized to 0-6 years, or >6 years of schooling. In Paper III education was not dichotomized, but used rather a continuous variable (with a mean±SD of 6.7±2.3).

Poor self-rated health was dichotomized and considered present, based on the 12-item Short-Form Health Survey question, "In general, would you say your health is...", when the answer was “poor” as opposed to the other alternatives answers “excellent”, “very good”, “good” and “fair”.

Number of medications used was defined as the number of daily medications without medicine pro renata. Number of medications could be considered as a proxy for number of diseases.

Analgesics, which included Opioids, NSAID and Paracetamol for regular use, were used as a proxy for pain.

Hypnotics were used as a proxy for sleeping disturbances.

Method of analysis – statistical analysis

A number of statistical analyses were used in this thesis.

Descriptive statistics:

- Mean, median, standard deviation (SD) and range (lowest and highest value).

Univariate statistical analyses:

- For comparing dichotomous variables the Chi-square (χ²) test for independence was used. When the expected frequency of any cell was less than 5 the Fischer’s Exact Probability Test was used instead.

- Pearson’s correlation coefficient for comparing continuous variables.

- Student’s T-test, i.e. independent-samples T-test, or (in Paper IV) Mann-Whitney U-test were used for comparing means.

- The Kruskal-Wallis test was used to compare multiple means.

In all tests a p-value <0.05 was regarded as statistically significant.
Predictive Analytics SoftWare (PASW) Statistic version 20 to 22 (SPSS Inc., Chicago, IL, USA) was used for calculations, except for Confirmatory Factor Analysis (CFA) where the IBM SPSS AMOS version 22 was used.

**Paper I – Psychometrics**

Reliability in the Umeå 85+/GERDA sample

- Internal consistency was evaluated using Cronbach’s α (Bland and Altman, 1997). Internal consistency is a test used to examine whether all the items of an assessment scale measure the same construct. The most common measure is Cronbach’s alpha and values vary between 0 and 1. Expected values are between 0.7 and 0.9. Alpha below 0.7 usually indicates poor internal consistency and values above 0.9 suggests items are very similar and perhaps fewer items could lead to similar results (Peacock and Peacock, 2011).

- The PGCM scale was also tested to see whether alpha increased if an item was removed and to see whether corrected item to total correlation was below 0.2 (Streiner and Norman, 2008).

Reliability in the convenience sample

- Intra-rater test-retest reliability in the convenience sample was evaluated by Intraclass Correlation Coefficient (ICC) (Bland, 2000).

- The intra-rater agreement was tested using Cohen’s kappa (Landis and Koch, 1977).

- The least significant change for a single assessment was calculated from the square root of standard deviation (SD), multiplied by the z-value for either 95% or 80% confidence intervals (CI) (√SD*1.96 for 95% CI and √SD*1.28 for 80% CI). To calculate the least significant change between two measurements (repeatability) the least significant change value for a single assessment was multiplied by the square root of 2 (Bland and Altman, 1996).
• The data were screened for linear heteroscedasticity (when the error all along the scale we are currently using does not have normal distribution it is called heteroscedasticity).

Construct validity

Validity can be tested in many ways. Face validity is a subjective consensus among experts about what the scale appears to measure. Content validity is also a subjective consensus among experts that the scale covers all the relevant areas. Criterion validity is usually tested by comparing similar constructs and examines how they correlate. Construct validity is ways in which to examine the scale internally to explore what it measures, usually by analysis if items cluster together to form “sub-scales” (Peacock and Peacock, 2011, Pallant, 2010).

When a scale is new it is common to test the construct validity using Exploratory Factor Analysis (EFA). One might say that the data are used to construct a model (Pallant, 2010). When Lawton constructed the PGCMS, he studied the construct validity in a sample of older people who answered the PGCMS questions and found that morale comprises three sub-scales or aspects (Lawton, 1972, Lawton, 1975). If EFA has been used on a scale and there is a need to test construct validity on other samples or in other languages, another technique, the Confirmatory Factor Analysis (CFA), is more often used. One might say that the previously suggested model is tested on the new data to examine how well it fits the model. There are several standardized indices (same word as “indexes”), or measures, that try to describe how well the model-to-data fit is. Scientists debate which indices best describe this fit and sometimes also the level that suggests rejection of the model or acceptable or good fit. When choosing the fit and level of fit to be used in Paper I, we followed both a previous article in the field (Pinar and Oz, 2011) and reliable writers of books (Blunch, 2013, Byrne, 2009) and writers of articles (Schermelleh-Engel et al., 2003, Schweizer, 2010) in the field.

All validity testing used the Umeå 85+/GERDA sample and only those able to answer all 17 PGCMS items. Confirmatory Factor Analyses were performed to test the construct validity. The maximum likelihood was used as the estimation method. A number of tests are used to test the fit of a model to the data (Table 1).
Table 1. Fit indices used in Paper I

<table>
<thead>
<tr>
<th>Fit indices</th>
<th>Good fit</th>
<th>Acceptable fit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root Mean Square Error of Approximation (RMSEA)</td>
<td>RMSEA&lt;0.05</td>
<td>RMSEA&lt;0.08</td>
</tr>
<tr>
<td>P value of Close Fit (PCLOSE)</td>
<td>PCLOSE&gt;0.5</td>
<td>PCLOSE &lt; 0.05</td>
</tr>
<tr>
<td>Goodness of Fit Index (GFI)</td>
<td>GFI≥0.95</td>
<td>GFI&gt;0.90</td>
</tr>
<tr>
<td>Adjusted Goodness of Fit Index (AGFI)</td>
<td>AGFI&gt;0.90</td>
<td>AGFI&gt;0.85</td>
</tr>
<tr>
<td>Comparative Fit Index (CFI)</td>
<td>CFI&gt;0.95</td>
<td>CFI≥0.90</td>
</tr>
</tbody>
</table>

The recommended factor loadings in the Confirmatory Factor Analyses model are >0.30 (Pinar and Oz, 2011).

Feasibility

The items with most missing answers were calculated to investigate if there were questions that were more difficult to answer.

The items with most missing answers were calculated to investigate whether there were some questions that were more difficult to answer. It was assumed that participants in the Umeå 85+/GERDA study who were asked MMSE questions were also asked PGCMS questions later in the interview. If the interviewer considered that the participants had inadequate cognitive capacity to answer the PGCMS questions, then they could not administer the PGCMS and it was classified as missing. To test whether the cognitive capacity had any impact on the percentage who could answer 16 or 17 of the PGCMS questions versus those who answered none or up to 15 questions, we plotted in a table the portion who could answer 16 or 17 questions according to how many MMSE questions they had answered.
**Paper II – Stroke and morale**

Variables with a possible association (p-value 0.15 or less) with the PGCMS scores from the univariate analysis were included in two multiple linear regression models to find variables independently associated with a low PGCMS score, one for those with stroke history and one for those without. Sex and age were included in the model regardless of their p-value. Backward, stepwise multiple regression analyses were used.

**Paper III – High morale and depression**

Logistic regression was used to investigate whether the baseline PGCMS level could predict depressive disorders at the five-year follow-up. To be regarded as a true confounder in logistic regression model one, a variable had to have a significance level of p<0.05 with both PGCMS at baseline and depressive disorders at five-year follow-up. In model two the significance level was raised to p<0.1 for possible association with both PGCMS at baseline and depressive disorders at the five-year follow-up. For model three, model two was used with the addition of the demographic variables age, gender and country, regardless of their p-value. Interaction for gender was controlled for by adding a variable where gender was multiplied by the PGCMS score, to see if there were gender differences. Sensitivity and specificity for each cut-off point were calculated and a ROC-curve was created.

**Paper IV – High morale and five-year survival**

Non-parametric tests, e.g. the Mann-Whitney U-test, are preferable for use when the variables tested have a non-normal distribution. If the number of participants is high enough, a parametric test, e.g. Student’s T-test, can often be used anyway since assumptions that are needed play a lesser role for parametric tests. Paper IV had a large sample with non-normal distribution, however we decided to follow the example of a previous article using a non-parametric test that had a younger and much larger sample, for better comparison between the articles (Benito-Leon et al., 2010). The rationale for using the PGCMS with three levels was also based on a precedent in previous work (Benito-Leon et al., 2010).
The relationship between survival and morale was explored using Cox Proportional Hazard Regression Analyses in three models, each with high morale as a reference group compared with low and moderate levels of morale:

- Unadjusted.
- Adjusted for age and gender.
- Adjusted for confounders associated with both morale and survival derived from the univariate analyses. In the last model, referred to as the multi-variable confounder model, age and gender were added regardless of their p-value and highly correlating variables (≥0.5) were excluded to reduce risk of multicollinearity.

Cox regressions were also carried out:

- With high morale as a reference but with low and moderate levels combined since the Kaplan-Meier curve showed overlap between low and moderate levels of morale.
- For the three age-groups separately.
- For each of the three sub-scales of the PGCMS treated as continuous variables.

**Additional analyses**

Reliability testing in the Umeå 85+/GERDA sample:

- A scatterplot and a linear regression line were used to visualize the absolute difference between first and second PGCMS assessments when different assessors were used. The linear regression line shows the stability of the two assessments according to time.
- ICC was used to calculate inter-rater re-test reliability.
Ethical considerations

When very old people, who can be both physically weak and have diseases such as dementia, aphasia and depression, take part in research the investigating scientists have to proceed gently and respectfully, both when consent to participate is to collected and when gathering data.

If it was suspected that the person did not have the cognitive capacity to give their consent to participating in the Umeå 85+/GERDA study, then consent was discussed with their next of kin. In the Convenience sample, the participants had to have the cognitive capacity to give informed consent to participate. Participation was voluntary and could be discontinued at any time.

All investigators in the Umeå 85+/GERDA study were either healthcare professionals or medical students with training in communicating with very old people. In the Convenience sample, experienced physician or nurses performed the interviews. Sometimes sensitive questions could evoke intense feelings for the participants that made it important to have educated personnel.

The interviews were conducted in the person’s own home. Investigators were observant of the interview becoming too strenuous for the participant and in such cases offered to take a pause and come back another day.

All the studies used in this thesis were approved by Ethics Committees. The information gathered from these two studies is kept and stored in a secure manner to prevent unauthorized access. The publications arising from these studies did not reveal any individual result or answers.

The study was approved by the Regional Ethical Review Board in Umeå, Sweden, (99-326, 05-063M, 09-178M, 2013-17-31M and 14-221-31M) and the Ethics Committee of Vaasa Central Hospital in Finland (05-87 and 10-54).
Results

Paper I – Psychometrics

A total of 493 individuals with an average age of 89.0±4.4 years answered all 17 PGCMS items in the Umeå 85+/GERDA study. Of these 64.5% were women, 80.2% lived alone, 73.0% were widowed, and 29.8% lived in institutions. Their mean PGCMS score was 11.9±3.2 (range 1-17). The convenience sample comprised 54 individuals with an average age of 84.7±6.7 years. Of these 66.7% were women, 75.9% lived alone and 72.2% lived in institutional care. Their mean PGCMS score was 11.3±3.9, range 2-17 (Table 2).

Table 2. Basic characteristics of the two samples used in this study. Both samples include only Swedish-speakers who answered all 17 Philadelphia Geriatric Center Morale Scale items.

<table>
<thead>
<tr>
<th></th>
<th>Umeå 85+/GERDA sample</th>
<th>Convenience sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>“Single test”</td>
<td>“Test-retest”</td>
</tr>
<tr>
<td></td>
<td>(n=493)</td>
<td>(n=54)</td>
</tr>
<tr>
<td>Women, n (%)</td>
<td>318 (64.5%)</td>
<td>36 (66.7%)</td>
</tr>
<tr>
<td>Age (mean±SD)</td>
<td>89.0±4.4</td>
<td>84.7±6.7</td>
</tr>
<tr>
<td>Living alone, n (%)</td>
<td>394 (80.2%)</td>
<td>41 (75.9%)</td>
</tr>
<tr>
<td>Widowed, n (%)</td>
<td>360 (73.0%)</td>
<td></td>
</tr>
<tr>
<td>Living in institutional care, n (%)</td>
<td>147 (29.8%)</td>
<td>39 (72.2%)</td>
</tr>
<tr>
<td>Education &gt;6 years, n (%)</td>
<td>188 (38.1%)</td>
<td></td>
</tr>
<tr>
<td>Dementia disorders, n (%)</td>
<td>84 (17.0%)</td>
<td></td>
</tr>
<tr>
<td>Depressive disorders, n (%)</td>
<td>135 (27.5%)</td>
<td></td>
</tr>
<tr>
<td>Stroke, n (%)</td>
<td>38 (7.7%)</td>
<td></td>
</tr>
<tr>
<td>MMSE (mean±SD)</td>
<td>23.5±5.0</td>
<td>22.6±5.3</td>
</tr>
<tr>
<td>Barthel’s ADL Index (mean±SD)</td>
<td>17.9±3.9</td>
<td>14.6±5.9</td>
</tr>
<tr>
<td>GDS-15 (mean±SD)</td>
<td>3.5±2.5</td>
<td></td>
</tr>
<tr>
<td>GDS-4 (mean±SD)</td>
<td>-1</td>
<td>0.93±1.1</td>
</tr>
<tr>
<td>PGCMS (mean±SD)</td>
<td>11.9±3.2, (range 1-17)</td>
<td>11.3±3.9, (range 2-17)</td>
</tr>
</tbody>
</table>

1Data not collected
SD= Standard deviation
ADL= Activities of daily living
MMSE= Mini-Mental State Examination
GDS= Geriatric Depression Scale
PGCMS= Philadelphia Geriatric Center Morale Scale
Reliability

Internal consistency, tested using Cronbach’s alpha, was 0.74 in the Umeå 85+/GERDA sample. The Cronbach’s alpha for the three factors was 0.65 for Agitation, 0.48 for Attitude Toward Own Aging and 0.62 for Lonely Dissatisfaction with mean PGCMS scores of 4.7±1.5, 2.4±1.4 and 4.8±1.4 for each factor respectively (Table 2). The corrected item to total correlation was below 0.2 for item number 8. Removal of item number 8 resulted in a small increase in Cronbach’s alpha (Table 3).
<table>
<thead>
<tr>
<th>Sample</th>
<th>Umeå 85+/GERDA sample</th>
<th>Convenience sample</th>
<th>Convenience sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>“Single test”</td>
<td></td>
<td>“Test-retest”</td>
</tr>
<tr>
<td>Number of participants</td>
<td>n=493</td>
<td>n=493</td>
<td>n=54</td>
</tr>
<tr>
<td>Statistical test</td>
<td>Cronbach’s alpha</td>
<td>Cronbach’s alpha if item removed</td>
<td>Corrected item to total correlation</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>0.741</td>
<td>0.649</td>
<td>0.618</td>
</tr>
<tr>
<td><strong>Agitation</strong></td>
<td>0.649</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Do little things bother you more this year? (^2)</td>
<td>0.716</td>
<td>0.469</td>
<td>70.4</td>
</tr>
<tr>
<td>7. Do you sometimes worry so much that you can’t sleep?</td>
<td>0.730</td>
<td>0.317</td>
<td>90.7</td>
</tr>
<tr>
<td>12. Are you afraid of a lot of things?</td>
<td>0.724</td>
<td>0.412</td>
<td>90.7</td>
</tr>
<tr>
<td>13. Do you get mad more than you used to?</td>
<td>0.737</td>
<td>0.236</td>
<td>83.3</td>
</tr>
<tr>
<td>16. Do you take things hard?</td>
<td>0.732</td>
<td>0.297</td>
<td>83.3</td>
</tr>
<tr>
<td>17. Do you get upset easily?</td>
<td>0.730</td>
<td>0.320</td>
<td>83.3</td>
</tr>
<tr>
<td><strong>Attitude Toward Own Aging</strong></td>
<td>0.484</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Do things keep getting worse as you get older?</td>
<td>0.728</td>
<td>0.342</td>
<td>74.7</td>
</tr>
<tr>
<td>2. Do you have as much energy as you did last year? (^1)</td>
<td>0.736</td>
<td>0.263</td>
<td>63.0</td>
</tr>
<tr>
<td>6. As you get older do you feel less useful? (^1)</td>
<td>0.731</td>
<td>0.312</td>
<td>70.4</td>
</tr>
<tr>
<td>8. As you get older, are things better than expected? (^1)</td>
<td>0.747</td>
<td>0.162</td>
<td>90.7</td>
</tr>
<tr>
<td>10. Are you as happy now as you were when you were younger?</td>
<td>0.736</td>
<td>0.262</td>
<td>77.8</td>
</tr>
<tr>
<td><strong>Lonely Dissatisfaction</strong></td>
<td>0.618</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Do you feel lonely much? (^1)</td>
<td>0.719</td>
<td>0.435</td>
<td>90.7</td>
</tr>
<tr>
<td>4. Do you see enough of your friends and relatives? (^2)</td>
<td>0.735</td>
<td>0.271</td>
<td>87.0</td>
</tr>
<tr>
<td>9. Do you sometimes feel that life isn’t worth living?</td>
<td>0.716</td>
<td>0.468</td>
<td>85.2</td>
</tr>
<tr>
<td>11. Do you have a lot to be sad about?</td>
<td>0.728</td>
<td>0.348</td>
<td>85.2</td>
</tr>
<tr>
<td>14. Is life hard for you most of the time?</td>
<td>0.725</td>
<td>0.411</td>
<td>90.7</td>
</tr>
<tr>
<td>15. Are you satisfied with your life today? (^1)</td>
<td>0.729</td>
<td>0.357</td>
<td>88.9</td>
</tr>
</tbody>
</table>

\(^1\) Items 2, 3, 6, 8, 14 and 15 have slightly different wording in the anglicised PGCMS version than Lawton’s 17-item version.

\(^2\) Note: The positions of items 4 and 5 accord with Lawton’s 17-item PGCMS version.
Further reliability testing was done with the convenience sample, which was used for intra-rater test-retesting (absolute reliability). The mean time between assessments was 3.9±1.9 days and the median time was 4 days. Intra-rater test-retest reliability analysis for the 17 items of the PGCMS showed that absolute agreement varied between 63.0-90.7% and Cohen’s Kappa varied between 0.24-0.77 (Table 3). The Intraclass Correlation Coefficient was calculated to 0.89 for the one-way random effect model. The least significant change between two assessments, with a 95% confidence level, was 3.53 PGCMS points and, with an 80% confidence level, 2.50 PGCMS points (Table 4).

Table 4. Intra-rater test-retest (absolute) reliability of the Swedish 17-item version of the Philadelphia Geriatric Center Morale Scale.

<table>
<thead>
<tr>
<th>Convenience sample “Test-retest” n=54</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intraclass correlation coefficient, one-way random-effect model</td>
</tr>
<tr>
<td>Intraclass correlation coefficient, two-way mixed-effect model</td>
</tr>
<tr>
<td>95% confidence interval for a single assessment</td>
</tr>
<tr>
<td>Least significant change between two assessments, 95% Confidence Interval level</td>
</tr>
<tr>
<td>80% confidence interval for a single assessment</td>
</tr>
<tr>
<td>Least significant change between two assessments, 80% Confidence Interval level</td>
</tr>
</tbody>
</table>

There was no linear heteroscedasticity, p= 0.219.
**Construct validity**

Validity testing was performed with CFA in four models using the Umeå 85+/GERDA sample (Table 5). The first model using all 17 items with one factor (Morale as factor) showed acceptable fit with GFI and AGFI but high RMSEA and unacceptably low PCLOSE, which led to rejection of this model. The second model suggested by Lawton with 17 items and three factors (Agitation, Lonely Dissatisfaction, Attitudes Toward Own Aging) showed a better fit than the first model. To further explore the 17-item three-factor model, adjustments were made for errors in items 3 and 4 as well as 16 and 17 (Figure 16). This third model showed good fit for RMSEA, PCLOSE, GFI and AGFI criteria and acceptable CFI. Since item 8 loaded below 0.3 in the CFA testing and because of the problems in the reliability testing mentioned above, a 16-item three-factor model, without item 8 and with the same error adjustments as with the 17-item model, was also tested. The 16-item three-factor model with error adjustments showed a fit similar to the 17-item three-factor model with error adjustments.
Table 5. Results from Confirmatory Factor Analysis of the Philadelphia Geriatric Center Morale Scale in the Umeå 85+/GERDA sample (n=493). Note: Calculations above were done with items 4 and 5 in the same positions as in Lawton’s 17-item version.

<table>
<thead>
<tr>
<th>Description</th>
<th>$\chi^2$</th>
<th>df</th>
<th>p-value</th>
<th>RMSEA</th>
<th>90% CI</th>
<th>PCLOSE</th>
<th>GFI</th>
<th>AGFI</th>
<th>CFI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 17-item 1-factor model$^1$</td>
<td>350</td>
<td>119</td>
<td>&lt;0.001</td>
<td>0.063</td>
<td>0.055-0.071</td>
<td>0.003</td>
<td>0.91</td>
<td>0.89</td>
<td>0.77</td>
</tr>
<tr>
<td>2 17-item 3-factor model$^2$</td>
<td>257</td>
<td>116</td>
<td>&lt;0.001</td>
<td>0.050</td>
<td>0.042-0.058</td>
<td>0.509</td>
<td>0.94</td>
<td>0.92</td>
<td>0.86</td>
</tr>
<tr>
<td>3 17-item 3-factor model - Adjusted$^3$</td>
<td>217</td>
<td>114</td>
<td>&lt;0.001</td>
<td>0.043</td>
<td>0.034-0.052</td>
<td>0.908</td>
<td>0.95</td>
<td>0.93</td>
<td>0.90</td>
</tr>
<tr>
<td>4 16-item 3-factor model - Adjusted$^4$</td>
<td>186</td>
<td>99</td>
<td>&lt;0.001</td>
<td>0.042</td>
<td>0.033-0.052</td>
<td>0.912</td>
<td>0.96</td>
<td>0.94</td>
<td>0.91</td>
</tr>
</tbody>
</table>

$\chi^2$=Chi-square for Goodness-of-Fit test  
df = Degrees of freedom  
RMSEA = Root Mean Square Error of Approximation  
CI = Confidence Interval of RMSEA  
PCLOSE = P value of Close Fit  
GFI = Goodness-of-Fit Index  
AGFI = Adjusted Goodness-of-Fit Index  
CFI = Comparative Fit Index

$^1$Using all 17 items of the PGCMS and single-factor Morale  
$^2$Using all 17 items of the PGCMS and the three factors Agitation, Lonely Dissatisfaction, Attitudes Toward Own Aging proposed by Lawton  
$^3$Adjusted for correlation between error for items 3 and 4 as well as 16 and 17  
$^4$Using 16 items of the PGCMS with item number 8 excluded in the model also with adjustment for correlation between error for items 3 and 4 as well as 16 and 17
Figure 16. The structure model used for the 17-item three-factor Philadelphia Geriatric Center Morale Scale model with adjustments for correlation between error for items 3 and 4 as well as 16 and 17. The positions of items 4 and 5 accord with Lawton’s 17-item version. The Umeå 85+/GERDA sample was used (n=493) with participants answering all 17 items.

ATOA = Attitudes Toward Own Aging  
LD = Lonely Dissatisfaction
Feasibility

Of the 598 individuals who answered PGCMS items in the Umeå 85+/GERDA study, 92.6% (554/598) answered 16 or more. The PGCMS items that had the highest number of missing answers were number 8, where 9.7% (58/598) did not answer, and number 10, where 7.2% (43/598) did not answer. For the remaining items, fewer than 3.3% did not answer.

Further, 722 individuals were assessed using the MMSE, of whom 17.3% (125/722), with a mean age of 90.8±4.8 years and comprising 76.8% women, for various reasons did not answer any PGCMS questions later in the interview. Of the 722 individuals who answered MMSE questions, 6.1% (44/722), with a mean age 90.9±4.6 years and comprising 77.8% were women, answered between 1 and 15 of the PGCMS questions. The remaining 76.6% (553/722) individuals answered 16 to 17 items. For each MMSE score the proportion who could answer 16 or 17 versus the proportion who answered 15 to none of the PGCMS questions is shown in Figure 17. On average 88.7% of those with 18 to 30 MMSE points answered 16 or 17 PGCMS questions. On average 60.3% of those with 8 to 17 MMSE points answered 16 or 17 PGCMS questions. Those with 8 to 17 MMSE points represent 25.1% (181/722) of those with an MMSE score (Figure 17).
Figure 17. Feasibility of the Philadelphia Geriatric Center Morale Scale. For each MMSE score the proportion who could answer 16 or 17 (bars) versus the proportion who answered 15 to none of the PGCMS questions is shown (n=722). On average 88.7%, represented by the upper dotted horizontal line, of those with 18 to 30 MMSE points answered 16 or 17 PGCMS questions. On average 60.3% of those with 8 to 17 MMSE points answered 16 or 17 PGCMS questions. This is shown by the lower dotted horizontal line.
Paper II – Stroke and morale

The prevalence of stroke was 22.0% (156 out of 708) in the study population. The prevalence of stroke was 23.8% among 85-year-olds (60 out of 252), 20.6% among 90-year-olds (51 out of 248) and 21.6% among 95-year-olds and older (45 out of 208).

Of the 708 participants, 465 could answer PGCMS questions and of these 95.8% answered 15 or more of the 17 questions. The 243 participants unable to answer PGCMS questions had a mean of 10.1±8.8 SD MMSE points, but only 57.6% were able to answer the MMSE, while the 465 participants able to answer the PGCMS had a mean of 22.4±5.4 SD and 93.8% of them were able to answer the MMSE.

Ninety-one of the 465 participants (19.6%) who could answer PGCMS questions had had a stroke. Within the group with a history of stroke 38.5% had high morale, 33.0% had intermediate and 28.6% had low morale. In the non-stroke group 49.2% had high morale, 29.7% had intermediate and 21.1% had low morale. There were significantly lower PGCMS scores among those 91 participants who had a history of stroke than among those without (10.9±3.8 SD vs. 12.1±3.0 SD, p-value 0.008). There were no differences between the group with a history of stroke and the group without regarding sex (p-value 0.719), age (p-value 0.689) or if living in Sweden or Finland (p-value 0.163).

Within the group of 91 individuals with a history of stroke who answered PGCMS questions, the following variables were associated with lower PGCMS scores: living in institutional care, visitors less than once a week, economic insufficiency, pain, impaired hearing, impaired vision, angina pectoris, constipation, dementia and depression (Table 6) and also age, Barthel ADL index, GDS, MMSE, and MNA scores (Table 7). In the final multivariate linear regression model, we chose to exclude MMSE and GDS score in favour of dementia and depression diagnoses. The variables independently associated with low PGCMS scores among those who had had a stroke were depression, angina pectoris and impaired hearing (Table 8).
Table 6. Comparison of mean PGCMS scores for a number of demographic and health-related variables within the stroke and the non-stroke groups using Student’s T-test

|                        | Stroke |                  | p     |  | Non-stroke |                  | p     |
|------------------------|--------|------------------|-------|  |------------|------------------|-------|
|                        | n=91   | PGCM mean score  |       |  | n=374      | PGCM mean score  |       |
| Women                  | y n=61 | 10.7             | 0.467 |  | n=258      | 11.9             | 0.072 |
|                        | n n=30 | 11.3             |       |  | n=16     | 12.5             |       |
| In institutional care  | y n=44 | 10.1             | 0.035 |  | n=99      | 11.3             | 0.004 |
|                        | n n=47 | 11.7             |       |  | n=275     | 12.4             |       |
| Living alone           | y n=71 | 10.7             | 0.239 |  | n=295     | 11.8             | 0.001 |
|                        | n n=20 | 11.8             |       |  | n=78      | 13.1             |       |
| Children (alive)       | y n=79 | 11.5             | 0.656 |  | n=302     | 12.0             | 0.073 |
|                        | n n=11 | 10.5             |       |  | n=45      | 12.2             |       |
| Visitor less than once a week | y n=15 | 8.9             | 0.024 |  | n=34      | 12.2             | 0.830 |
|                        | n n=76 | 11.3             |       |  | n=340     | 12.1             |       |
| Economical insufficiency | y n=17 | 10.4             | 0.131 |  | n=43      | 10.6             | 0.002 |
|                        | n n=58 | 11.9             |       |  | n=277     | 12.6             |       |
| Education              | y n=25 | 10.4             | 0.329 |  | n=252     | 12.0             | 0.604 |
| >7 years               | n n=62 | 11.2             |       |  | n=96      | 12.2             |       |
| Religious activities important | y n=46 | 11.2             | 0.611 |  | n=166     | 12.0             | 0.639 |
|                        | n n=33 | 10.8             |       |  | n=154     | 12.2             |       |
| Pain (in last week)    | y n=45 | 10.3             | 0.109 |  | n=201     | 11.5             | 0.001 |
|                        | n n=45 | 11.6             |       |  | n=168     | 12.8             |       |
| Impaired hearing       | y n=16 | 7.7              | <0.001 |  | n=63      | 12.0             | 0.842 |
|                        | n n=75 | 11.6             |       |  | n=306     | 12.1             |       |
| Impaired vision        | y n=25 | 9.2              | 0.008 |  | n=52      | 11.0             | 0.003 |
|                        | n n=66 | 11.6             |       |  | n=320     | 12.3             |       |
| Angina pectoris        | y n=44 | 10.1             | 0.037 |  | n=138     | 11.4             | <0.001 |
|                        | n n=47 | 11.7             |       |  | n=235     | 12.5             |       |
| Constipation           | y n=45 | 10.1             | 0.046 |  | n=125     | 11.3             | 0.001 |
|                        | n n=46 | 11.7             |       |  | n=249     | 12.5             |       |
| Diabetes               | y n=17 | 11.8             | 0.275 |  | n=51      | 12.4             | 0.388 |
|                        | n n=74 | 10.7             |       |  | n=323     | 12.0             |       |
| Dementia               | y n=32 | 9.7              | 0.017 |  | n=95      | 11.5             | 0.040 |
|                        | n n=59 | 11.6             |       |  | n=270     | 12.3             |       |
| Depression             | y n=46 | 9.1              | <0.001 |  | n=118     | 9.7              | <0.001 |
|                        | n n=45 | 12.8             |       |  | n=256     | 13.2             |       |
| Heart failure          | y n=30 | 10.7             | 0.782 |  | n=107     | 11.5             | 0.031 |
|                        | n n=61 | 11.0             |       |  | n=267     | 12.3             |       |
| Indwelling urinary catheter | y n=6  | 9.5              | 0.339 |  | n=10      | 9.5              | 0.007 |
|                        | n n=85 | 11.0             |       |  | n=364     | 12.1             |       |
| Malignancy (in last five years) | y n=11 | 11.0             | 0.943 |  | n=40      | 11.1             | 0.003 |
|                        | n n=80 | 10.9             |       |  | n=334     | 12.9             |       |
| Sleeping disorder      | y n=40 | 10.8             | 0.827 |  | n=136     | 11.2             | <0.001 |
|                        | n n=61 | 11.0             |       |  | n=238     | 12.6             |       |
| Urinary incontinence   | y n=27 | 11.3             | 0.541 |  | n=91      | 11.1             | <0.001 |
|                        | n n=64 | 10.7             |       |  | n=283     | 12.4             |       |

PGCM – Philadelphia Geriatric Morale Scale

y=yes, n=no
Table 7. The correlations of the PGCMS score to a number of continuous variables of demographic and health-related factors in the stroke group and non-stroke group

<table>
<thead>
<tr>
<th></th>
<th>Stroke (n=91)</th>
<th>Non-stroke (n=374)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pearson’s correlation to PGCMS score</td>
<td>p</td>
</tr>
<tr>
<td>Age</td>
<td>-0.25</td>
<td>0.017</td>
</tr>
<tr>
<td>Barthel ADL index</td>
<td>0.337</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>BMI</td>
<td>0.098</td>
<td>0.362</td>
</tr>
<tr>
<td>GDS</td>
<td>-0.655</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>MMSE</td>
<td>0.402</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>MNA</td>
<td>0.412</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Within the group of 374 individuals without a history of stroke who answered PGCMS questions the following variables were associated with lower PGCMS scores: institutional care, living alone, children alive, economic insufficiency, pain, impaired vision, angina pectoris, constipation, dementia, depression, heart failure, indwelling urinary catheter, malignancy (in last five years), sleeping disorder, urinary incontinence (Table 6) and also age, Barthel ADL index, GDS, MMSE and MNA scores (Table 7). Variables independently associated with low morale among those without history of stroke were: depression, pain (in last week) and poor nutritional status i.e. lower MNA (Table 8).
Table 8. Multiple linear regression models. Variables with an independent association with PGCMS score among those with a history of stroke and those without. Only variables with a p-value below 0.05 are shown, apart from age and sex.

<table>
<thead>
<tr>
<th></th>
<th>Stroke n=91 Unstandardized β</th>
<th>95% CI for β</th>
<th>p</th>
<th>Non-Stroke n=374 Unstandardized β</th>
<th>95% CI for β</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(constant)</td>
<td>12.235</td>
<td></td>
<td></td>
<td>9.743</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>0.019</td>
<td>-1.691 - +1.730</td>
<td>0.982</td>
<td>-0.161</td>
<td>-0.107 - +0.035</td>
<td>0.320</td>
</tr>
<tr>
<td>Age</td>
<td>-0.088</td>
<td>-0.276 - +0.099</td>
<td>0.351</td>
<td>-0.047</td>
<td>-0.115 - +0.020</td>
<td>0.169</td>
</tr>
<tr>
<td>Depression</td>
<td>-2.892</td>
<td>-4.425 - -1.360</td>
<td>&lt;0.001</td>
<td>-2.923</td>
<td>-1.531 - -0.400</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Impaired Hearing(^\d)</td>
<td>-3.082</td>
<td>-5.126 - -1.038</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angina Pectoris</td>
<td>-1.567</td>
<td>-3.080 - -0.055</td>
<td>0.042</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MNA</td>
<td></td>
<td></td>
<td></td>
<td>0.167</td>
<td>0.081 - +0.253</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Pain (in last week)</td>
<td></td>
<td></td>
<td></td>
<td>-0.965</td>
<td>-1.531 - -0.400</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Stroke model: $R^2 = 0.406$, Adjusted $R^2 = 0.368$, p-value = <0.001
Non-Stroke model: $R^2 = 0.371$, Adjusted $R^2 = 0.360$, p-value = <0.001
MNA – Mini Nutritional Assessment

\(^\d\) Impaired hearing was defined as unable to hear normal conversation at a distance of 1 m, with or without hearing aids.
Paper III – High morale and depression

The 647 individuals, who answered 12 or more PGCMS items at baseline, had a mean PGCMS score of 11.7±3.2 and a mean age of 89.1±4.4 years (Mean±SD), range 85-103. Of these, 70.3% (455/647) did not have depressive disorders at baseline and had a mean PGCMS score of 12.7±2.8. At the five-year follow-up, 242 of the 455 individuals without depressive disorder at baseline were still alive, of whom 10.7% (26/242) declined and 89.3% (216/242) re-accepted participation. Those 216 individuals who agreed to participate again had an average baseline PGCMS score of 13.0±2.8 and a mean age of 92.6±3.4 years, range 90-104, at the five-year follow-up. Of those without depressive disorders at baseline and who agreed to the five-year follow-up, 74.5% (161/216) did not have depressive disorders at the five-year follow-up, and had an average baseline PGCMS score of 13.6±2.7. The remaining 25.5% (55/216) had an average baseline PGCMS score of 11.5±2.8 (Figure 18).

Figure 18 also shows that 29.7% (192/647) of the individuals in the sample had depressive disorders at baseline and they had an average PGCMS score of 9.4±3.0. At the five-year follow-up 68 individuals were still alive, of whom 14.7% (10/68) declined and 85.3% (58/68) agreed to participate again. The 58 individuals with depressive disorders at baseline and who accepted the five-year follow-up had an average baseline PGCMS score of 10.0±3.4 and a mean age of 92.1±2.5 years, range 90-101, at the five-year follow-up. Of these 27.6% (16/58), with an average baseline PGCMS of 10.2±2.4, recovered from their depressive disorders, and the 72.4% (42/58) who still had depressive disorders according to the definition used in the study, had an average baseline PGCMS of 9.9±3.7. The five-year mortality among those without depressive disorders at baseline was 46.8% (213/455) which was significantly lower than the 64.6% (124/192) among those with depressive disorders at baseline (p<0.001).
Figure 18. Flowchart of study population. Baseline data were collected 2000 to 2002 and 2005 to 2007, and the corresponding five-year follow-up collection in 2005 to 2007 and 2010 to 2012. All PGCMS values in the figure are baseline PGCMS.
The characteristics for those with and without depression at baseline are shown in Table 9. Several variables were significantly associated with depression at baseline. The characteristics of those without depressive disorders at baseline based on whether they had depressive disorders five years later or not, are shown in Table 10. The PGCMS score at baseline was the only variable that had a significant association with depressive disorders five years later. Social isolation, hypertension and a history of stroke reached the p<0.1 level with relation to depressive disorders at the five-year follow-up. However, only social isolation reached the p<0.1 association with the PGCMS score at baseline (Table 11 and 12).
### Table 9. Baseline characteristics for the whole sample

<table>
<thead>
<tr>
<th>Baseline characteristics for the whole sample (n=647)</th>
<th>No depressive disorder (n=455)</th>
<th>Depressive disorders (n=192)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morale (PGCMS) at baseline</td>
<td>12.7±2.8</td>
<td>9.4±3.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Socio-demographical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>89.0±4.5</td>
<td>89.4±4.3</td>
<td>0.293</td>
</tr>
<tr>
<td>Gender (female)</td>
<td>64.4%</td>
<td>74.5%</td>
<td>0.016</td>
</tr>
<tr>
<td>Country (Sweden)</td>
<td>79.8%</td>
<td>78.1%</td>
<td>0.713</td>
</tr>
<tr>
<td>Years of education</td>
<td>6.7±2.3</td>
<td>6.7±2.3</td>
<td>0.829</td>
</tr>
<tr>
<td>In institutional care</td>
<td>24.0%</td>
<td>44.3%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Living alone</td>
<td>85.7%</td>
<td>91.1%</td>
<td>0.077</td>
</tr>
<tr>
<td>Social isolation¹</td>
<td>32.4%</td>
<td>42.2%</td>
<td>0.033</td>
</tr>
<tr>
<td>Perceived social isolation</td>
<td>16.7%</td>
<td>2.7%</td>
<td>0.007</td>
</tr>
<tr>
<td>Feeling lonely</td>
<td>39.7%</td>
<td>70.2%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Feeling unsafe</td>
<td>2.8%</td>
<td>7.8%</td>
<td>0.012</td>
</tr>
<tr>
<td>Functionally related</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity level (Barthel ADL index)</td>
<td>18.3±3.6</td>
<td>16.2±4.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cognitive function (MMSE)</td>
<td>24.2±4.7</td>
<td>21.5±5.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Impaired hearing</td>
<td>15.2%</td>
<td>14.1%</td>
<td>0.814</td>
</tr>
<tr>
<td>Impaired vision</td>
<td>11.0%</td>
<td>20.8%</td>
<td>0.002</td>
</tr>
<tr>
<td>Nutritional status (MNA)</td>
<td>24.9±3.2</td>
<td>22.2±3.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Health-related</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor self-rated health</td>
<td>3.4%</td>
<td>12.2%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Constipation</td>
<td>21.5%</td>
<td>35.9%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Heart failure</td>
<td>15.2%</td>
<td>27.1%</td>
<td>0.001</td>
</tr>
<tr>
<td>Hypertension</td>
<td>52.5%</td>
<td>56.3%</td>
<td>0.435</td>
</tr>
<tr>
<td>History of stroke</td>
<td>13.6%</td>
<td>17.2%</td>
<td>0.295</td>
</tr>
<tr>
<td>No of drugs for regular use</td>
<td>5.3±3.7</td>
<td>8.7±4.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Analgesics²</td>
<td>34.3%</td>
<td>54.2%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hypnotics</td>
<td>23.9%</td>
<td>39.2%</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Student’s T-test and Chi-square was used  
Numbers indicate mean±SD or the column percentage. Number of participants for each variable is only noted if there are some missing values.

¹Social isolation was considered present if the participant’s number of visits per week, either having visitors or visiting someone, was once a week or less  
²Analgesics include: Opioids, NSAID and Paracetamol, for regular use

ADL – Activities of Daily Living  
PGCMS – Philadelphia Geriatric Center Morale Scale  
MMSE – Mini Mental State Examination  
MNA – Mini Nutritional Assessment

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Table 10. Baseline characteristics for the sub-group without baseline depressive disorders distributed according whether the participants had a depressive disorder or not five years later.

<table>
<thead>
<tr>
<th></th>
<th>No depressive disorder at follow-up (n=161)</th>
<th>Depressive disorders at follow-up (n=55)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morale (PGCMS) at baseline</td>
<td>13.6±2.7</td>
<td>11.5±2.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Socio-demographical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>87.5±3.4</td>
<td>87.7±3.4</td>
<td>0.691</td>
</tr>
<tr>
<td>Gender (female)</td>
<td>68.9%</td>
<td>70.9%</td>
<td>0.917</td>
</tr>
<tr>
<td>Country (Sweden)</td>
<td>80.7%</td>
<td>87.3%</td>
<td>0.372</td>
</tr>
<tr>
<td>Years of education</td>
<td>6.8±2.3 (n=154)</td>
<td>7.0±2.1 (n=49)</td>
<td>0.550</td>
</tr>
<tr>
<td>In institutional care</td>
<td>14.3%</td>
<td>9.1%</td>
<td>0.449</td>
</tr>
<tr>
<td>Living alone</td>
<td>82.0%</td>
<td>89.1%</td>
<td>0.307</td>
</tr>
<tr>
<td>Social isolation¹</td>
<td>33.1%</td>
<td>22.0%</td>
<td>0.094</td>
</tr>
<tr>
<td>Perceived social isolation</td>
<td>14.0%</td>
<td>13.2%</td>
<td>1.00</td>
</tr>
<tr>
<td>Feeling lonely</td>
<td>39.1%</td>
<td>49.1%</td>
<td>0.256</td>
</tr>
<tr>
<td>Feeling unsafe</td>
<td>2.6%</td>
<td>1.9%</td>
<td>1.00*</td>
</tr>
<tr>
<td>Functional related</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity level (Barthel ADL index)</td>
<td>19.5±1.7</td>
<td>19.4±1.2</td>
<td>0.707</td>
</tr>
<tr>
<td>Cognitive function (MMSE)</td>
<td>25.9±3.2</td>
<td>26.0±2.8</td>
<td>0.877</td>
</tr>
<tr>
<td>Impaired hearing</td>
<td>6.9% (n=160)</td>
<td>10.9% (n=55)</td>
<td>0.386*</td>
</tr>
<tr>
<td>Impaired vision</td>
<td>5.6% (n=160)</td>
<td>7.3% (n=55)</td>
<td>0.744*</td>
</tr>
<tr>
<td>Nutritional status (MNA)</td>
<td>25.7±2.4</td>
<td>25.7±2.8</td>
<td>0.862</td>
</tr>
<tr>
<td>Health related</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor self-rated health</td>
<td>1.3% (n=159)</td>
<td>3.7% (n=54)</td>
<td>0.267*</td>
</tr>
<tr>
<td>Constipation</td>
<td>14.9%</td>
<td>21.8%</td>
<td>0.328</td>
</tr>
<tr>
<td>Heart failure</td>
<td>7.5%</td>
<td>9.1%</td>
<td>0.772*</td>
</tr>
<tr>
<td>Hypertension</td>
<td>50.9%</td>
<td>65.5%</td>
<td>0.087</td>
</tr>
<tr>
<td>History of stroke</td>
<td>9.9%</td>
<td>20.0%</td>
<td>0.087</td>
</tr>
<tr>
<td>No of drugs for regular use</td>
<td>4.4±3.3</td>
<td>5.1±3.2</td>
<td>0.222</td>
</tr>
<tr>
<td>Analgesics²</td>
<td>26.1% (n=199)</td>
<td>29.1%</td>
<td>0.797</td>
</tr>
<tr>
<td>Hypnotics</td>
<td>19.7% (n=157)</td>
<td>24.5% (n=53)</td>
<td>0.586</td>
</tr>
</tbody>
</table>

Student T-test, Chi-square and in some occasions *Fischer’s test were used
Numbers indicate mean±SD or the column percentage. Number of participants for each variable is only noted if there are some missing values.

¹Social isolation was considered present if the participant’s number of visits per week, either having visitors or visiting someone, was once a week or less
²Analgesics include: Opioids, NSAID and Paracetamol, for regular use

ADL – Activities of Daily Living
PGCMS – Philadelphia Geriatric Center Morale Scale
MMSE – Mini Mental State Examination
MNA – Mini Nutritional Assessment
Table 11. The association between dichotomous variables at baseline with PGCMS at baseline for those without depressive disorder at baseline.

<table>
<thead>
<tr>
<th>Sub-group</th>
<th>Percent of total</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Socio-demographical</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender (female)</td>
<td>64.4%</td>
<td>0.034</td>
</tr>
<tr>
<td>Country (Sweden)</td>
<td>79.8</td>
<td>0.159</td>
</tr>
<tr>
<td><strong>Socio-economic</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In institutional care</td>
<td>24.0%</td>
<td>0.004</td>
</tr>
<tr>
<td>Living alone</td>
<td>85.7%</td>
<td>0.009</td>
</tr>
<tr>
<td>Social isolation¹</td>
<td>32.4%</td>
<td>0.009 (n=408)</td>
</tr>
<tr>
<td>Perceived social isolation</td>
<td>16.7%</td>
<td>0.019 (n=437)</td>
</tr>
<tr>
<td>Poor self-rated health</td>
<td>3.4%</td>
<td>&lt;0.001 (n=438)</td>
</tr>
<tr>
<td>Feeling lonely</td>
<td>39.7%</td>
<td>&lt;0.001 (n=451)</td>
</tr>
<tr>
<td>Feeling unsafe</td>
<td>2.8%</td>
<td>&lt;0.001 (n=431)</td>
</tr>
<tr>
<td><strong>Bodily functions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impaired hearing</td>
<td>15.2%</td>
<td>0.534 (n=453)</td>
</tr>
<tr>
<td>Impaired vision</td>
<td>11.0%</td>
<td>0.051 (n=453)</td>
</tr>
<tr>
<td><strong>Disease-/health-related</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constipation</td>
<td>21.5%</td>
<td>0.189 (n=454)</td>
</tr>
<tr>
<td>History of heart failure</td>
<td>15.2%</td>
<td>0.002 (n=454)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>52.5%</td>
<td>0.800</td>
</tr>
<tr>
<td>History of stroke</td>
<td>13.6%</td>
<td>0.879</td>
</tr>
</tbody>
</table>

Student’s T-test was used

¹ Social contacts 0 to 1 times per week either from friends or relatives coming to visit at own home or the participants themselves visiting someone away from home.
Table 12. The correlation for continuous variables at baseline with PGCMS at baseline for those without depressive disorder at baseline.

<table>
<thead>
<tr>
<th>Correlation with PGCMS at baseline for sub-group “no depressive disorder” (n=455)</th>
<th>Mean</th>
<th>Correlation</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGCMS at baseline</td>
<td>12.7±2.7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Socio-demographical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>89.0±4.468</td>
<td>-0.073</td>
<td>0.121</td>
</tr>
<tr>
<td>Socio-economical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years of education</td>
<td>6.7±2.3</td>
<td>0.027</td>
<td>0.583</td>
</tr>
<tr>
<td>(n=431)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bodily functions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functional level (Barthel ADL index)</td>
<td>18.3±3.6</td>
<td>0.133</td>
<td>0.005</td>
</tr>
<tr>
<td>(n=454)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive function (MMSE)</td>
<td>24.2±4.7</td>
<td>0.079</td>
<td>0.093</td>
</tr>
<tr>
<td>Mini Nutritional Assessment (MNA)</td>
<td>24.9±3.2</td>
<td>0.195</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(n=424)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disease-/health-related</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of medications</td>
<td>5.3±3.7</td>
<td>-0.128</td>
<td>0.006</td>
</tr>
<tr>
<td>Analgesics¹</td>
<td>0.34±0.48</td>
<td>-0.089</td>
<td>0.058</td>
</tr>
<tr>
<td>Hypnotics</td>
<td>0.3</td>
<td>-0.033</td>
<td>0.482</td>
</tr>
</tbody>
</table>

Pearson’s Correlation used
¹Analgesics include: Opioids, NSAID and Paracetamol, for regular use

PGCMS – Philadelphia Geriatric Center Morale Scale
ADL – Activities of Daily Living
MMSE – Mini Mental State Examination
MNA – Mini Nutritional Assessment

Three models were tested using logistic regression (Table 13). Model 1 showed a lower risk of depressive disorders five year later with higher PGCMS scores (odds ratio of 0.779, p<0.001, for a one-point increase in PGCMS with 95% Confidence Interval 0.87-0.69). Model 2 included social isolation as a confounder and the PGCMS score showed a result similar to that in model 1, with significance only for the PGCMS score. Model 3, where model 2 was used with the addition of the variables age, gender and country, showed a similar result for the PGCMS score and none of the other variables were significant. No interaction for gender was seen, i.e. the relationship seems valid regardless of sex.
Table 13. Logistic and multivariate logistic regression models to investigate whether PGCMS at baseline can predict depressive disorder five years later (n=216).

<table>
<thead>
<tr>
<th>Model</th>
<th>Logistic regression</th>
<th>Model fit</th>
<th>Equation</th>
<th>Odds ratio</th>
<th>95 % CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>H&amp;L</td>
<td>Nagelkerke R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 1:</td>
<td>PGCMS at baseline</td>
<td>0.077</td>
<td>0.134</td>
<td>0.779</td>
<td>0.69-0.87</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Model 2:</td>
<td>PGCMS at baseline</td>
<td>0.042</td>
<td>0.143</td>
<td>0.775</td>
<td>0.68-0.88</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Social isolation (no=0, yes=1)</td>
<td></td>
<td></td>
<td>0.498</td>
<td>0.23-1.10</td>
<td>0.085</td>
</tr>
<tr>
<td>Model 3:</td>
<td>PGCMS at baseline</td>
<td>0.037</td>
<td>0.154</td>
<td>0.777</td>
<td>0.69-0.88</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Social isolation (no=0, yes=1)</td>
<td></td>
<td></td>
<td>0.486</td>
<td>0.22-1.09</td>
<td>0.082</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td></td>
<td></td>
<td>1.042</td>
<td>0.94-1.15</td>
<td>0.416</td>
</tr>
<tr>
<td></td>
<td>Gender (male=0, women=1)</td>
<td></td>
<td></td>
<td>0.925</td>
<td>0.43-1.97</td>
<td>0.839</td>
</tr>
<tr>
<td></td>
<td>Country (Sweden = 0, Finland=1)</td>
<td></td>
<td></td>
<td>1.722</td>
<td>0.62-4.76</td>
<td>0.295</td>
</tr>
</tbody>
</table>

H&L = Hosmer and Lemeshow Test (good model fit >0.05)
Pseudo-R = Nagelkerke R square
PGCMS – Philadelphia Geriatric Center Morale Scale

Model 1: To be added as confounder in model 1 the variable had to have a p< 0.05 for both PGCMS at baseline and depressive disorder at year five. No confounding variable reached this significance level.

Model 2: To be added as confounder in model 1 the variable had to have a p< 0.1 for both PGCMS at baseline and depressive disorder at year five. Only social isolation reached this level of significance and was added to the model.

Model 3: included both the variable from model 2 and some basic demographic variables.
Visualized in Table 14 are the cut-off both at 12 and 13 points; they produce the highest sensitivity and specificity for the ability of the PGCMS scores to identify depressive disorders five years later. Figure 19 shows Receiver Operating Characteristic (ROC) curve; the area under the curve was 0.739.

Table 14. Different PGCMS value cut-offs at baseline and their sensitivity and specificity for depression five years later

<table>
<thead>
<tr>
<th>Cut-off PGCMS score</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 points or lower</td>
<td>0.927</td>
<td>0.217</td>
</tr>
<tr>
<td>14 points or lower</td>
<td>0.836</td>
<td>0.385</td>
</tr>
<tr>
<td>13 points or lower</td>
<td>0.8</td>
<td>0.571</td>
</tr>
<tr>
<td>12 points or lower</td>
<td>0.655</td>
<td>0.783</td>
</tr>
<tr>
<td>11 points or lower</td>
<td>0.509</td>
<td>0.863</td>
</tr>
<tr>
<td>10 points or lower</td>
<td>0.182</td>
<td>0.932</td>
</tr>
</tbody>
</table>

Figure 19. The Receiver Operating Characteristic (ROC) curve. PGCMS values for three cut-offs from Table 14 are shown in the figure. Area under ROC curve = 0.739.
In the Umeå 85+/GERDA study sample of 646 individuals, participants with high morale were younger, used fewer medications and were less often living in institutional care, living alone, socially isolated or malnourished compared to participants with low and moderate morale. They also had higher functional levels, fewer diseases, included a lower proportion of women and a lower proportion of participants with impaired vision (Table 15). Morale was significantly higher at baseline for those who were still living after the five-year follow-up than for those who died within the five-year period (PGCMS score 12.7 ± 3.0 vs. 11.3 ± 3.1, p-value<0.001) (Table 16).
Table 15. Demographic and basic characteristics stratified according to level of morale (n=646).

<table>
<thead>
<tr>
<th></th>
<th>Participants with low morale (n=141)</th>
<th>Participants with moderate morale (n=203)</th>
<th>Participants with high morale (n=302)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age in years</strong></td>
<td>89.9 ± 4.3 (90.0)</td>
<td>89.5 ± 4.9 (90.0)</td>
<td>88.5 ± 4.1 (86.0)</td>
<td>0.008</td>
</tr>
<tr>
<td>85-year-olds</td>
<td>n=49 (34.8%)</td>
<td>n=99 (48.8%)</td>
<td>n=161 (53.3%)</td>
<td></td>
</tr>
<tr>
<td>90-year-olds</td>
<td>n=58 (41.1%)</td>
<td>n=51 (25.1%)</td>
<td>n=95 (31.5%)</td>
<td></td>
</tr>
<tr>
<td>95 years of age or older</td>
<td>n=34 (24.1%)</td>
<td>n=53 (26.1%)</td>
<td>n=46 (15.2%)</td>
<td></td>
</tr>
<tr>
<td><strong>Gender (female)</strong></td>
<td>104 (73.8%)</td>
<td>141 (69.5%)</td>
<td>190 (62.9%)</td>
<td>0.057</td>
</tr>
<tr>
<td><strong>Geographical area</strong></td>
<td></td>
<td></td>
<td></td>
<td>0.848</td>
</tr>
<tr>
<td>Sweden¹ (n=512)</td>
<td>114 (22.3%)¹</td>
<td>161 (31.4%)¹</td>
<td>237 (46.3%)¹</td>
<td></td>
</tr>
<tr>
<td>Finland¹ (n=134)</td>
<td>27 (20.1%)²</td>
<td>42 (31.3%)²</td>
<td>65 (48.5%)²</td>
<td></td>
</tr>
<tr>
<td>In institutional care</td>
<td>57 (40.4%)</td>
<td>74 (36.5%)</td>
<td>64 (21.2%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Living alone</td>
<td>125 (88.7%)</td>
<td>169 (83.3%)</td>
<td>223 (73.8%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Social contacts less than once a week</td>
<td>27 (21.3%)</td>
<td>26 (14.1%)</td>
<td>30 (10.7%)</td>
<td>0.018</td>
</tr>
<tr>
<td>Education &gt;6 years</td>
<td>78 (58.6%)</td>
<td>103 (55.1%)</td>
<td>161 (56.5%)</td>
<td>0.818</td>
</tr>
<tr>
<td>Impaired hearing</td>
<td>31 (22.0%)</td>
<td>26 (12.9%)</td>
<td>39 (13.0%)</td>
<td>0.029</td>
</tr>
<tr>
<td>Impaired vision</td>
<td>32 (22.9%)</td>
<td>36 (17.7%)</td>
<td>22 (7.3%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Functional level (Barthel ADL index)</td>
<td>16.7 ± 4.8 (19.0)</td>
<td>16.9 ± 4.8 (19.0)</td>
<td>18.7 ± 2.8 (20.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Malnutrition (MNA)</strong></td>
<td>22.0 ± 4.0 (22.0)</td>
<td>23.8 ± 3.5 (24.5)</td>
<td>26.3 ± 2.9 (26.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Constipation</td>
<td>66 (46.8%)</td>
<td>81 (39.9%)</td>
<td>76 (25.2%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Dementia disorders</td>
<td>29 (20.6%)</td>
<td>50 (24.6%)</td>
<td>40 (13.2%)</td>
<td>0.004</td>
</tr>
<tr>
<td>Depressive disorders</td>
<td>88 (62.4%)</td>
<td>80 (39.4%)</td>
<td>23 (7.6%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Heart failure</td>
<td>52 (36.9%)</td>
<td>62 (30.5%)</td>
<td>60 (19.9%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sleeping disorder</td>
<td>72 (51.4%)</td>
<td>88 (43.3%)</td>
<td>88 (29.1%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Stroke</td>
<td>25 (17.7%)</td>
<td>37 (18.2%)</td>
<td>54 (17.9%)</td>
<td>0.992</td>
</tr>
<tr>
<td>Number of medications</td>
<td>8.0 ± 4.5 (7.0)</td>
<td>7.0 ± 4.5 (6.0)</td>
<td>5.1 ± 3.6 (4.0)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Using Chi-square and Kruskal-Wallis tests.
Mean values ± SD (Median) are given for age, functional level, malnutrition and number of medications.
¹ Percentage for geographical area is presented for line total.

ADL – Activities of Daily Living
MNA – Mini Nutritional Assessment
Table 16. Demographic and basic characteristics at baseline stratified according to being dead or alive after the five-year follow-up period among those (n=646) answering 12 or more of the PGCMS questions.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Dead (n=353)</th>
<th>Alive (n=293)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years (Median)</td>
<td>90.5 ± 4.8 (90.0)</td>
<td>87.5 ± 3.3 (86.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>85-year-olds</td>
<td>206 (48.5%)</td>
<td>219 (51.5%)</td>
<td></td>
</tr>
<tr>
<td>90-year-olds</td>
<td>275 (67.1%)</td>
<td>135 (32.9%)</td>
<td></td>
</tr>
<tr>
<td>95 years of age or older</td>
<td>286 (89.9%)</td>
<td>32 (10.1%)</td>
<td></td>
</tr>
<tr>
<td>Gender (Women)</td>
<td>221 (62.6%)</td>
<td>214 (73.0%)</td>
<td>0.005</td>
</tr>
<tr>
<td>Geographical area</td>
<td></td>
<td></td>
<td>0.309</td>
</tr>
<tr>
<td>Sweden (n=512)</td>
<td>285 (55.7%)</td>
<td>227 (44.3%)</td>
<td></td>
</tr>
<tr>
<td>Finland (n=134)</td>
<td>68 (50.7%)</td>
<td>66 (49.3%)</td>
<td></td>
</tr>
<tr>
<td>In institutional care</td>
<td>155 (43.9%)</td>
<td>40 (13.7%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Living alone</td>
<td>290 (82.2%)</td>
<td>227 (77.5%)</td>
<td>0.178</td>
</tr>
<tr>
<td>Social contacts less than once a week</td>
<td>43 (13.7%)</td>
<td>40 (14.4%)</td>
<td>0.782</td>
</tr>
<tr>
<td>Education &gt;6 years</td>
<td>128 (39.1%)</td>
<td>135 (48.6%)</td>
<td>0.025</td>
</tr>
<tr>
<td>Impaired hearing</td>
<td>72 (20.5%)</td>
<td>24 (8.2%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Impaired vision</td>
<td>72 (20.5%)</td>
<td>18 (6.2%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Functional level (Barthel ADL) (Median)</td>
<td>16.5 ± 4.8 (19.0)</td>
<td>19.1 ± 2.3 (20.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Malnutrition (MNA) (Median)</td>
<td>23.2 ± 3.8 (23.5)</td>
<td>25.1 ± 3.0 (25.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Constipation</td>
<td>149 (42.2%)</td>
<td>74 (25.3%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Dementia disorders</td>
<td>95 (26.6%)</td>
<td>24 (8.2%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Depressive disorders</td>
<td>128 (36.3%)</td>
<td>63 (21.5%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Heart failure</td>
<td>134 (38.1%)</td>
<td>40 (13.7%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sleeping disorder</td>
<td>140 (39.7%)</td>
<td>108 (37.0%)</td>
<td>0.540</td>
</tr>
<tr>
<td>Stroke</td>
<td>69 (19.5%)</td>
<td>47 (16.0%)</td>
<td>0.292</td>
</tr>
<tr>
<td>Number of medications (Median)</td>
<td>7.2 ± 4.6 (7.0)</td>
<td>5.2 ± 3.7 (5.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total PGCMS score (Median)</td>
<td>11.3 ± 3.1 (11.0)</td>
<td>12.7 ± 3.0 (13.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Agitation (Median)</td>
<td>4.7±1.5 (5.0)</td>
<td>4.9±1.4 (5.0)</td>
<td>0.224</td>
</tr>
<tr>
<td>Lonely Dissatisfaction (Median)</td>
<td>4.6±1.4 (5.0)</td>
<td>4.9±1.3 (5.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Attitude Toward Own Aging (Median)</td>
<td>2.1±1.4 (2.0)</td>
<td>2.7±1.4 (3.0)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Using Chi-square and Mann-Whitney U tests.
Mean values ± SD (Median) are given for age, functional level, malnutrition, number of medications and PGCMS and its sub-scales.

1Percentage for geographical area is presented for line total.
2Sub-scale of the PGCMS.

ADL – Activities of Daily Life
MNA – Mini Nutritional Assessment
PGCMS – Philadelphia Geriatric Center Morale Scale
The five-year survival rate was 31.9% (45/141) in the low morale group, 39.4% (80/203) in the moderate morale group and 55.6% (168/302) in the high morale group. The unadjusted Cox regression analysis showed an increased relative mortality risk for both low morale (RR=1.86, 95% CI=1.43-2.43, p<0.001) and moderate morale (RR=1.59, 95% CI=1.24-2.03, p<0.001) groups compared to the high morale group. The patterns for the three age groups were similar to the pattern for the whole sample; however for those aged 95 years or older the increased mortality risk was non-significant. When adjusting for age and gender, an increased relative mortality risk was found for the groups with low morale (RR=1.73, 95% CI=1.33-2.26, p<0.001) and moderate morale (RR=1.46, 95% CI=1.14-1.87, p=0.003), compared to the high morale group. In the multi-variable confounder model an increased relative mortality risk was found for the group with low morale (RR=1.36, 95% CI=1.03-1.80, p=0.032) compared to the group with high morale. The moderate morale group showed a similar trend towards an increased relative mortality risk, non-significantly however (Table 17).
Table 17. The Cox Proportional Hazard Regression Analyses.

<table>
<thead>
<tr>
<th>Morale level</th>
<th>Unadjusted</th>
<th>Adjusted for age and gender</th>
<th>Adjusted for multiple confounders</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total n=646</td>
<td>By age group</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>85-year-olds n=309</td>
<td>90-year-olds n=204</td>
</tr>
<tr>
<td></td>
<td>RR 95% CI</td>
<td>RR 95% CI</td>
<td>RR 95% CI</td>
</tr>
<tr>
<td>High</td>
<td>1.00 -</td>
<td>1.00 -</td>
<td>1.00 -</td>
</tr>
<tr>
<td>(n=302)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>1.59*</td>
<td>1.28 0.85– 1.79 1.14– 1.39 0.90–</td>
<td>1.46 1.14–</td>
</tr>
<tr>
<td>(n=203)</td>
<td>** 2.03</td>
<td>* 2.81</td>
<td>2.14</td>
</tr>
<tr>
<td></td>
<td>*** 2.42</td>
<td>** 2.93</td>
<td>2.09</td>
</tr>
<tr>
<td>Low</td>
<td>1.86 1.43–</td>
<td>1.77 1.11– 1.90 1.24– 1.28 0.78–</td>
<td>1.73* 1.33–</td>
</tr>
<tr>
<td>(n=141)</td>
<td></td>
<td>* 2.80</td>
<td>** 2.26</td>
</tr>
</tbody>
</table>

| PGCMS sub-scales   |            |                             |                                  |                                  |
|--------------------|------------|-----------------------------|----------------------------------|
| Agitation          | 0.94 0.88– | 0.92 0.86–                  | 0.99 0.88–                      |
|                    | 1.02       | * 0.98                      | 1.12                             |
| Lonely Dissatisfaction | 0.90 0.84– | 0.93 0.86–                  | 1.00 0.88–                      |
|                    | ** 0.97    | 1.00                        | 1.34                             |
| Attitude Toward    | 0.84 0.77– | 0.87 0.80–                  | 0.90 0.79–                      |
| Own Aging          | *** 0.91   | ** 0.95                     | 1.03                             |

*p<0.05, **p<0.01, ***p<0.001, RR = Relative Risk, CI = Confidence Interval

1 Age and gender model: adjustments have been made for age and gender

2 Multi-variable confounder model: adjustments have been made for variables significantly associated, i.e. with a p-value of less than 0.05, with both morale level and five-year survival (from Tables 15 and 16). However institutional care and malnutrition (MNA) had a high correlation (more than 0.5) with functional level (the Barthel ADL index) and they were excluded to reduce the risk of multicollinearity. Depressive disorder was also excluded since it had a high correlation with PGCMS score. Age and gender was included regardless of significance level. The variables that were used in our multi-variable confounder model were: age, gender, impaired hearing, impaired vision, functional level (the Barthel ADL index), constipation, dementia, heart failure, number of medications.

3 The group aged 95 years or older group had a mean age of 96.6 ± 1.6 SD (range 95-103 years)
Low and moderate levels of morale partly overlapped, as illustrated in the Kaplan-Meier curve (Figure 20). To further explore this finding, three additional Cox regression models were performed with morale divided into two levels, where high level of morale (13-17 points) was compared with the original low and moderate levels of morale combined (0-12 points). An increased relative risk of mortality was found with unadjusted Cox regression analysis for the combined group with low and moderate levels of morale (RR=1.70, 95% CI=1.37-2.11, p<0.001) as well as when adjusted for age and gender (RR=1.57, 95% CI=1.26-1.95, p<0.001) compared with the high morale group. In the multi-variable confounder model, the combined low and moderate morale levels showed increased relative mortality risk, non-significantly however (RR=1.25, 95% CI=0.99-1.57, p=0.059), compared with high morale.

Cox regressions showed that higher ATOA reduces the relative mortality risk in both the unadjusted (RR=0.84, 95% CI=0.77-0.91, P<0.001) and the age and gender model (RR=0.87, 95% CI=0.80-0.95, P=0.001) but not in the multi-variable confounder model (Table 17).

Women had lower morale than men did (11.6±3.2 vs. 12.4±3.0, p=0.001). The proportion of women was also higher among survivors (Table 16).
Figure 20. Kaplan-Meier curves showing the cumulative survival for 646 participants (mean age 89.1±4.4, range 85-104 years) who answered twelve or more PGCMS questions according to the three levels of morale. PGCMS – Philadelphia Geriatric Center Morale Scale

The x-axis denotes follow-up time in years and the Y-axis denotes the cumulative survival of the participants. The five-year survival rate for high morale (1) was 55.6%, for moderate morale (2) 39.4 % and for low morale (3) 31.9%. A line at 50% shows median survival. Those still living after five years were censored.
Additional results

PGCMS was assessed in the Umeå 85+/GERDA study for the years 2000-2002 and there were 301 participants. Other interviewers visited 120 of the participants between one week and ten months later for a second assessment of the PGCMS (Table 18).

Table 18. Basic characteristics of the two samples

<table>
<thead>
<tr>
<th>Re-test sample in the Umeå 85+/GERDA study (n=120)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women, n (%)</td>
</tr>
<tr>
<td>Age, (mean±SD)</td>
</tr>
<tr>
<td>Living alone, n (%)</td>
</tr>
<tr>
<td>Widowed, n (%)</td>
</tr>
<tr>
<td>Living in institutional care, n (%)</td>
</tr>
<tr>
<td>Barthel’s ADL, (mean±SD)</td>
</tr>
<tr>
<td>MMSE, (mean±SD)</td>
</tr>
<tr>
<td>MNA, (mean±SD)</td>
</tr>
<tr>
<td>GDS, (mean±SD)</td>
</tr>
<tr>
<td>PGCMS – 1st assessment, (mean±SD)</td>
</tr>
<tr>
<td>PGCMS – 2nd assessment, (mean±SD)</td>
</tr>
</tbody>
</table>

SD= Standard deviation
ADL=Activities of daily living
MMSE= Mini-Mental State Examination
MNA= Mini-Nutritional Assessment
GDS= Geriatric Depression Scale
PGCMS= Philadelphia Geriatric Centre morale Scale
Figure 21 shows the stability of the two PGCMS assessment between one week and ten months. The absolute difference between the first and second assessment is shown on the y-axis and difference in days on the x-axis. Approximately 28% did not change. The plotted line shows that the more time that passes, the greater the difference between the first and second measurements, however, the p-value for the regression was not significant.

Figure 21. Stability of the Swedish PGCMS (n=120). Absolute difference between first and second assessments of the PGCMS and on the y-axis and time between assessments in days on the x-axis. (R²=0.024, Beta=1.216, p=0.093)
In table 19, the ICC is shown according to time periods. The group was divided into two halves and the median time was at three months.

<table>
<thead>
<tr>
<th>Time</th>
<th>ICC</th>
</tr>
</thead>
<tbody>
<tr>
<td>One week to three months (n=60)</td>
<td>0.795</td>
</tr>
<tr>
<td>Three months to ten months (n=60)</td>
<td>0.699</td>
</tr>
</tbody>
</table>
Discussion

Summary of main results

The validity and reliability of the Swedish version of the PGCMS seems to be acceptable and comparable with other research results in the field. It also seems feasible to use PGCM among very old people.

A stroke prevalence of 21.6-23.8% was found in a sample of very old people in northern Sweden and western Finland. Participants with a history of stroke had a significantly lower morale, measured using the PGCMS, although 38.5% were considered to have high morale. In addition, a multiple linear regression model showed that depression, angina pectoris and hearing deficits was independently associated with low morale among those with a stroke history.

The higher the morale, the lower the risk of depressive disorders five years later among very old people. The PGCMS has high sensitivity and specificity in identifying individuals at risk of having depressive disorders five years later. In addition, a quarter of those without depressive disorders at baseline had a depressive disorder five years later and two thirds of those with depressive disorders at baseline had died.

High morale seems to be associated with increased survival even when adjusting for confounders associated with both morale and survival.

Psychometrics of the Swedish PGCMS

The psychometric properties of the Swedish version of the PGCMS have not previously been tested and the PGCMS has not been specifically tested on very old people.
Reliability

Internal consistency – the Cronbach’s alpha

Internal consistency was 0.74 for the Swedish 17-item version of the PGCMS in the Umeå 85+/GERDA sample tested with the Cronbach’s alpha and was considered acceptable (Table 3). Other researchers have found an internal consistency of the PGCMS ranging from 0.60 for a Spanish translation (Stock et al., 1994) of Lawton’s original 22-item version of the scale to 0.92 for a 15-item Turkish version of the scale (Pinar and Oz, 2011). The Cronbach’s alpha of the three factors in this study was 0.649 for Agitation, 0.484 for Attitudes Toward Own Aging and 0.618 for Lonely Dissatisfaction, which was similar to the results of Morris & Sherwood (Morris and Sherwood, 1975) who used a 15-item scale (0.62-0.76), but Lawton’s (Lawton, 1975) values were higher (0.81-0.85) for the 17-item version.

Agreement – test-retest

Cohen’s Kappa is a measure of inter- or intra-rater agreement and varies between -1 and +1 (Peacock and Peacock, 2011). In Paper I Cohen’s Kappa varied between 0.24-0.77 (Table 3) and according to Landis and Koch, this result varies from slight to good (Landis and Koch, 1977). There were three items, 2, 5 and 6, where the Kappa was especially low, i.e. below 0.4. This indicates a slightly higher measurement error but does not justify removal of any of these questions.

The results from the intra-rater test-retest within one week from the convenience sample (Table 4) show an Intraclass Correlation Coefficient of 0.89, which is similar to the 0.91 within five weeks found in previous research (Morris and Sherwood, 1975). In additional data in this thesis, the PGCMS was tested using different raters and when tested between one week and three months alpha was 0.795 and when tested between three months and ten months alpha was 0.699 (Table 19). The decrease of the level in the ICC between when re-assessment was done within one week by the same assessor, ICC was almost 0.9 (Table 4), to when re-assessment was done between one week and three months by different assessors, ICC was almost 0.8 (Table 19), could be due to the difference in using one or two testers. However, the continued decrease in the ICC when re-assessment was performed between three months and ten months, ICC almost 0.7, indicates that with an increase in time there is a decreasing concordance between first and second answer. The range was identical in the two samples, which could have affect-
ed the ICC otherwise. There was also a slight difference in age between the two samples, which might have affected the result, the convenience sample was aged 84.7±6.7 and the Umeå 85+/GERDA study was aged 89.1±4.4 years.

Measurement error or repeatability

When an assessment scale measurement is repeated, the result is not always the same. This may be because of natural variation both in the person being interviewed or, variation in the process of measurement, or perhaps both. This suggests that there is a measurement error, which must be taken into account when tests are repeated. The variance is used to calculate the measurement error (Bland and Altman, 1996). Results from Paper I suggest that a change of 3.53 points or more is required to detect a significant change between two assessments with a 95% confidence interval level and, likewise that 2.50 points are required with an 80% confidence interval level (Table 4). Further analysis is needed to clarify whether this is a clinically relevant change between two assessments.

Problematic items

Item 8 (“As you get older, are things better than expected?”) was the question that the highest number of individuals (9.7%) in the Umeå 85+/GERDA study did not answer. The corrected item to total correlation was also below 0.2 for item 8, indicating that the item might not measure the same thing as the scale as a whole. There are several explanations for the problems with item 8. It might be influenced by the participants’ problems in recalling past expectations of what life as an old person would be like and, arguably, it might be considered the most cognitively challenging question in the whole scale. Cultural or translational aspects might also explain the problems.

Construct validity

Construct validity was tested with CFA in our sample of very old people from the Umeå 85+/GERDA study. The model is presented in Figure 16. The Chi-square for Goodness-of-fit test and Degrees of freedom are measures that depends heavily on sample size (Blunch, 2013). The 17-item three-factor
model showed a good fit for all indices presented in Table 5 except CFI, where it showed acceptable fit according to standards. CFI is a relative fit and sometimes considered a problematic fit index (Blunch, 2013, Raykov, 2005, Raykov, 2000). In summary, the 17-item three-factor model showed a generally good fit, i.e. a reasonably close fit to the data, and the model should not, therefore, be rejected.

Feasibility

It is important to study feasibility to determine whether the scale is useful in clinical practice, especially among those with cognitive impairment. Despite an advanced age in the Umeå 85+/GERDA study, a large proportion (92.6%) of those answering PGCMS questions answered 16 or 17 of them. As many as 60% of those with severe cognitive impairment, i.e. those with an MMSE score between 8 and 17, answered 16 or 17 of the PGCMS items compared to those who answered between 15 and none (Figure 17). A similar result was seen in a younger convenience sample (Ryden and Knopman, 1989). The PGCMS seems feasible to use among very old people.

Classification – low/moderate/high morale

Lawton considered scores between 0 and 9 points to indicate low morale, 10 to 12 intermediate and 13 to 17 high morale (Lawton, 2003). This classification has no clear scientific background but to date it has received the support of the research community. In Paper III the best predictive PGCMS scores were between 12 and 13 points and in Paper IV low and moderate levels of morale seem to have similar survival rate. It could be argued that these two articles therefore suggest a new dichotomized classification (Table 14, Figure 19 and Figure 20). The new classification suggested by the results in Papers III and IV is based on the old limits, however, instead of three levels high/moderate/low, the new classification suggests only two levels – high (13 to 17 points) and low (0 to 12 points). At least it seems that the dichotomized classification is useful when studying very old people. Further research is needed to verify whether the new classification is also useful in younger age groups and which of the two systems is to be preferred.
**Stroke**

As previously mentioned, the WHO estimates that approximately 10% of people aged 85 years and above will have had a stroke in most Western European countries (Truelsen et al., 2006). The stroke diagnosis in Paper II was based on self-reported diagnosis, information from key informants, focal signs and medical records, all of which were validated by a specialist. In Paper II, those living in institutions were also included as well as those with a dementia disorder. This information led to a higher prevalence than estimated by the WHO. However, another Swedish study found comparable prevalence rates using a method similar to that used in Paper II (Liebetrau et al., 2003). Those most severely affected by their stroke were included in the prevalence number but probably did not answer the PGCMS questions due, for example, to aphasia or severe dementia and our result may not therefore be fully representative of very old people who had had a stroke in general.

In Paper II the PGCMS was used to measure a decrease in morale among very old people (mean age 90.3 years). The PGCMS was not designed for use in people who have had stroke, but it seems applicable in individuals with a history of stroke (Löfgren et al., 1999). The PGCMS as a measure of Quality of Life among those with a stroke history has advantages among very old people in that it is relatively easy to answer the “yes” or “no” questions. Therefore, it could be used in individuals with limited cognitive capacity. The disadvantage of PGCMS as a measure of quality of life among those with stroke is that it is not a stroke-specific scale and might fail to evaluate important areas of Quality of Life in those who have had a stroke. Stroke-specific Quality of Life measures such as “The Stroke Impact Scale” and “The Stroke-Specific Quality of Life Scale” have the advantage that they measure stroke-specific symptoms (Carod-Artal and Egido, 2009, Kranciuakaite and Rastenye, 2006), but the disadvantages that they have much more complex answer alternatives, making them less suitable for use in the very old, with or without stroke.

In Paper II a lower level of morale was detected among those with a history of stroke. There are many possible reasons for both high and low morale among those with a stroke history. First, there were several reasons for finding individuals with high morale among those with a stroke history, almost 40%. If the stroke-event was small and insignificant, then it is highly unlikely that it would have any effect on morale. It is also possible that those with high morale before their stroke did not experience any reduction in their level of morale caused by the stroke and kept their high morale in spite of the event (Figure 22).
In the case of individuals with stroke, and a subsequent decrease in the level of morale, who underwent successful rehabilitation after the stroke event where functions affected were recovered, it is also likely that their morale will recover, or almost, to its previous level. Similarly, a person with a severe stroke and subsequent decrease in morale who did not experience a successful rehabilitation, but acquired coping mechanisms that could help them to adapt to the new situation and set new goals in life might find that this could lead to an increase in the level of morale (Figure 23). This raises the question of whether people with high morale before the stroke event are also better equipped to benefit from rehabilitation or find the processes of adjusting easier.

Figure 22. High morale unaffected by stroke event
Another possible reason why high morale is observed in people who have had a stroke could be denial. Denial is considered a maladaptive coping mechanism. This could also be seen as a direct mechanism of “neglect” problems, usually associated with stroke injuries in the right-sided cerebral hemisphere. Neglect is usually characterized by inability of a person to process and perceive stimuli on one side of the body or environment (Hemi agnosia) but it can also involve inability to perceive the disease itself (Anosognosia).

A return to a previously high level of morale may also depend on mechanisms we can assume that humans possess regardless of rehabilitation efforts. The ability to adapt after losses in wellbeing was mentioned in the Discussion section as “time heals everything” or the “Hedonic treadmill” (Mroczek and Spiro, 2005). Some scientists argue that adapting to reduction in wellbeing is often incomplete. The incomplete adaptation could be accumulated and later lead to a permanent decline in wellbeing. Moreover, there are probably individual differences in the success of these adaptation skills (Mroczek and Spiro, 2005).

There are also older people who, despite problems in various areas such as health, social, economic and others, are able to have high wellbeing or quality of life, without denial-coping mechanisms, known as the ”disability paradox”. Thus, some people manage, against all odds, to think life is great even after a severe stroke.

Secondly, there are several reasons for low morale among those with a history of stroke. As previously stated, and probably constituting the main reason, the stroke event is a serious adverse event and the very reason those with a stroke history have a lower level of morale than those without (Figure 24).
Both a high (a in Figure 24) or moderate level (b in Figure 24) of morale can be reduced to a low level of morale.

![Graph showing the relationship between morale and time after a stroke event](image)

Figure 24. High morale (a) or moderate (b) reduced to low level due to the stroke event

Another explanation is that those who have low morale may be more prone to have stroke events. Thus, the stroke itself is not the cause of the low morale level rather the person had low morale from the start (Figure 25).

Yet another explanation is that the decline in morale is caused by depression due to the stroke. However, one can still argue that the stroke is the original cause. The low morale could also be explained by factors other than of the stroke, that we have not been able to adjust for in this thesis.
Depression was independently associated with low morale amongst both those who had and not had a stroke. Impaired hearing was independently associated with low PGCMS scores in the stroke group in our study but not among those with no stroke history. Many studies have shown there is a higher quality of life after a stroke a firm social network exists (Åström et al., 1992, Clarke et al., 2002, Kim et al., 1999, King, 1996). Hearing loss was found to affect communication, sociability and the psychological aspect of the quality of life for the elderly in general and is one of the most common impairments among elderly people (Tsuruoka et al., 2001). One possible explanation might be that the connection between impaired hearing and lower morale among those who had a stroke may be due to problems in obtaining support from their social network. Social isolation, due to impaired hearing, and having had a stroke could be regarded as a double handicap. Angina pectoris was also independently associated with low PGCMS scores in our linear regression model. Patients with angina pectoris may have a reduced quality of life because of their symptoms, impaired activity and anxiety (Gandjour and Lauterbach, 1999).
Depression

It seems that the PGCMS score in very old people can be useful when identifying individuals at risk of developing depressive disorder five years later (Table 13). Future studies aimed at finding health-promoting factors for those among very old at risk of depressive disorders could be focused on those at high risk rather than on the general population if the PGCMS were used as a screening tool. The ROC curve in Figure 19 and Table 14 shows that the PGCMS both at 12 and 13 points has high sensitivity and specificity in predicting depressive disorders. Since treatment directed at improving morale would benefit most individuals but might also be costly, it seems more important in this case to have a test to rule people in, rather than rule them out, as regards to identifying individuals at risk of depressive disorders five years later. It therefore seems that 13 points or lower is an appropriate cut-off for the PGCMS score. The area under the ROC curve (0.739) implies that the test has a moderately high predictive power.

Survival

High morale has previously been shown to be associated with survival in a study investigating a younger old-age population than that used in Paper IV (mean age of 75.7 ± 6.1 versus 89.1 ± 4.4 years) (Benito-Leon et al., 2010). The result from the total sample in Paper IV agrees with that from the earlier study. In one of the three age groups, those aged 95 years or older, the pattern tended towards increased survival for the high morale group, but did not reach significance (Table 17). Possible explanations for this might be the reduced power due to small sample size in this group. They also had, as expected, a very high mortality rate, even in the high morale group, and the follow-up time might be too long to achieve significance.

In Paper IV, since there was a high correlation between depression and PGCMS scores in our study and Agitation, one of the subscales in PGCMS, is considered to measure anxiety and dysphoric mood elements, depressive disorder was excluded as a confounder to avoid multicollinearity. The proportion of depressive disorders was high in the low, compared with the high morale group. This finding is in line with other research since morale is known to correlate negatively with depressive symptoms. This may have contributed to our main finding, since depression has been linked to reduced survival among very old people; however there are authors who disagree (Rapp et al., 2008).
Both Benito-León et al, who examined old people in Spain (Benito-Leon et al., 2010) and Paper IV, where very old people in Sweden and Finland were examined, found that morale was lower among women and yet women had a higher five-year survival rate. There are many possible reasons for this. Pinquart and Sörensen argue that older women’s disadvantages, compared with men, regarding socio-economic status, health, everyday competence and widowhood are the reasons for gender differences in wellbeing (Pinquart and Sörensen, 2001). However, Bennett argues that only recent widowhood can predict psychological wellbeing (Bennett, 2005). Wong et al argue that possible contributing factors include a higher prevalence of chronic disabling conditions, lower self-esteem and lower educational level in women compared to men (Wong et al., 2004). Although the exact reasons are not known, it can be summarized in the saying: “Men die, women suffer”.

**Refining the model for Morale**

**A different view of the factors that comprise morale**

At the start of the thought process behind this thesis, we assumed that the PGCMS was a measure of Quality of Life and we also assumed that the three variables morale comprised was: Agitation, Lonely Dissatisfaction and Attitudes Toward Own Aging. Over the years of working with morale, we realized that PGCMS primarily measures morale, but that this measure correlates with other measures of Quality of Life. In addition, in the research process, we wanted to explore the possibility that morale could be used as an explanatory variable. However, most research had focused on low morale and its negative effect. We now looked at morale as a possible positive health force where high morale can be seen as a salutogenic factor. Therefore, we also needed to look with new eyes at what comprises morale. Instead of the rather negative approaches of “Agitation”, “Lonely Dissatisfaction” and the objective “Attitudes Toward Own Aging” it might be fruitful to look at the model as positive resources included in morale (Figure 26).
Emotional resources: When Lawton constructed the PGCMS he defined the negative pole of the emotional part of morale as “Agitation” and the positive pole as “freedom from distressing symptoms and satisfaction with self”.

Social resources: When Lawton constructed the PGCMS he defined the negative pole of the social part of morale as “Lonely Dissatisfaction” and the positive pole as “a feeling of syntony between self and environment”. For the social resources, not only frequency of contacts but also the quality of the contacts are important. This has been shown in research into “social capital” (Nyqvist et al., 2013), which is another word for social resources.

Positive Attitudes Toward Own Aging (PATOA): One can assume that very few have all positive or all negative attitudes toward their own ageing, or to use a metaphor black and white are probably less common, instead there are more shades of grey. Reflecting on one’s goals and attitudes toward one’s own ageing is a cognitive process. The word cognitive is used here in a broad sense since there are people with dementia who have high morale.

Although Lawton does not define Attitudes Toward Own Aging as optimism or pessimism, there are similarities since whether a person is defined as an
optimist or pessimist depends on their expectancies; much like the saying: “if a glass is half full or half empty”. To my knowledge there has been no research that tries to explore differences and similarities between Attitudes Toward Own Aging and dispositional optimism. Dispositional optimism is optimism in general (Carver and Scheier, 2014) and Attitudes Toward Own Aging seems to be more future-oriented (Mannell and Dupuis, 1996).

Parallels can be drawn from the research on optimism that can shed some light on morale and PATOA in particular. Optimism has been shown to protect against depression (Giltay et al., 2006b) and stroke (Kim et al., 2011) and even cardiovascular death (Giltay et al., 2006a, Giltay et al., 2004) in old age.

Arguments against the view of morale as a positive force, comprising emotional, social resources and positive attitudes towards own aging, is that some of the 17 questions of the PGCMS concern negative affect or rather absence of something negative. The scoring system considers this and allows for higher points for better morale. Some researchers also argue that positive and negative affect not necessarily are each other’s counterparts but rather separate dimensions (McDowell, 2006). Therefore, arguably there is a need not only for questions that ask for the positive aspects, but also for some asking for the absence of negative affect, as in the PGCMS.

The perspective in Paper II that morale is a measure of quality of life and, particularly, that it declines after an adverse or negative life event, might miss the possibilities of high morale. Since low morale correlates with depression, having the low morale perspective means that many research findings will be similar to the finding of depression. As high morale does not correlate as much with depression, new research findings are possible with this view. This leads to next change in perspective that high morale can have an effect on other variables. This means that high morale can be viewed as a possible salutogenic property, which could be a productive way of looking at it. For instance, treatment of depression among old people is difficult and it might be easier to try to prevent it by enhancing salutogenic factors. This leads to a dualistic view of morale, as both a dependent and independent variable. In addition is the view, as previously stated, that morale is relatively stable, but since it seems to be able to change it is also dynamic in nature.

Below, I will combine the new perspective of morale and its three factors with the findings in Papers II-IV, together with previous knowledge about what affects morale to produce a refined model (in Figure 27,28 and 29). First, background factors that might affect morale will be described in Figure 27.
**MORALE IN VERY OLD PEOPLE**

Background factors that might affect morale

Micro level – Individual
- Genes (?), Upbringing (?)
- Gender, personality
- Psychological health
- Physical health/diseases
- ADL-function
- Vision/hearing impairment
- Religion/spirituality
- Education (?)
- Changes over time

Meso level – Inter-individual
- Social network
- Living alone
- Home environment
- Aids
- Home care
- Socio-economical status

Macro level – society
- Attitudes – Ageism
- Laws and rules
- Pensions/Taxes
- Healthcare and Aid systems (?)

Figure 27. Refined model for morale
Background factors

Micro level – individual level

A number of factors on the individual level could affect the level of morale in a person and some are mentioned here, such as genes, upbringing and educational level etc. We do not know about the link between genes, upbringing and morale. There could be genetic reasons for the level of morale but as far as I know, there is no research in the area. It is not unlikely that a safe upbringing would nurture a high morale. On the other hand, having to fight one’s way through the childhood years might also foster a fighting attitude that could be associated with high morale in advanced age. In the introduction to this thesis, a number of factors that might possibly affect morale were mentioned, such as age, gender, physical and psychological health, functional factors, vision and hearing problems, economic, hobbies, religion and most likely spirituality as well as personality. Paper II also support that hearing impairment may be important. One can speculate that education is of importance for morale too, through higher socio-economic status.

There is to my knowledge only one study investigating changes in morale over time and it showed a small but significant reduction in morale among old people over a twelve year period (Scott and Butler, 1997). Arguments supporting that morale declines even when specifically studying very old people from this thesis are that morale declines with increasing age, a lower mean PGCMS score with older age groups was seen in Paper IV (Table 15) and in Paper II a negative correlation of morale with age among both those with and those without stroke history (Table 7). There were one more study examining relationship between morale and longevity on a younger population, also found statistically higher mean age for lower levels of morale (Benito-Leon et al., 2010). Since it is likely that morale declines with increasing age it is not surprising to find individuals with low morale among those with a stroke history, but it is more surprising to find individuals with high morale among those with a stroke history. This puts the focus on the importance of investigating the health-promoting, or salutogenic, strength of having high morale.

Changes over time, i.e. over generations, could also occur. Not much is known about the change in morale over time. There are studies, like the SWEOLD or H70 in Gothenburg, which examines changes over generations up to 30 years apart, using repeated cross-sectional studies, which might be useful for drawing some conclusions about the kind of changes that occur over generations. However, none of the mentioned studies examines morale.
The Umeå 85+/GERDA study will eventually be able to draw some conclu-
sions when the data on morale collected from those interviewed in the year
2000 are compared with those interviewed at a similar age fifteen years later
in 2015.

Meso level – Inter-individul (group level)

At this level, the social network and the environment close to the individual
are important. In paper III we found an association (p<0.1) with social isola-
tion and surprisingly not with perceived social isolation or feeling lonely.
However, in support of this finding one study, using the PGCMS as a meas-
ure of quality of life, found that if an increase in the number of friends was
associated with a decrease in depression among old people (Demura and
Sato, 2003). It seems logical that action taken to improve social network –
increase the social capital – in terms of both quantity and quality for very old
people would improve morale. Loneliness appears to be a major burden for
many frail old people.

One unexpected finding in the previous mentioned study on the longitudinal
effect of morale was that being married in that start of the 12-year study pe-
riod was associated with a later decline in morale. The authors speculate that
one explanation to this finding could be that they became they became wid-
ows or widowers. In addition, there was also an indication that a decline in
morale for those who were still married was associated with caregiving to the
spouse and this might exhausts energy reserve and reduced opportunities to
meet friends (Scott and Butler, 1997). For the samples used in this thesis
approximately, 75-80% of the participants were already living alone and
therefore one can speculate that there will be fewer that can become widow
or widower with less chance that it will affect morale for the whole group.

Even though the Umeå 85+/GERDA study include both rural and urban
areas, in this thesis we did not examine the possible differences in morale
from an urban versus rural perspective. Rural environments with often long-
er distances to healthcare and to family and friends, less public transpor-
tation, less opportunities to get support from volunteer organizations etc than
an urban area might have. On the other hand, people are probably more used
to helping family, friends and neighbours in a rural area and might have
taken proactive actions to maintain social support. Even if it is a generaliza-
tion, one might say that rural areas have higher quality in social network for
very old people where urban areas have higher quantity. It is difficult to
speculate if this will result in different levels of morale for rural and urban areas.

There are many factors in the environment that could be of importance: if basic needs are met with the help of aids, homecare, medical care, and of course, food, water and other necessities for living. A speculation is that the socio-economic status might have an impact the environment situation for some very old people and this might affect morale.

Macro level – Society level

One can argue that the boundaries for a good life as an older person are defined on the macro level, with laws and rules, pension and taxes and healthcare and aid systems etc. In addition, attitudes in society toward older people, and in particular “ageism”, which is a negative attitude towards older people that is both discriminating and stereotyping, are of importance for old people (Andersson, 2008). Ageism was studied in a GERDA survey study, which runs parallel to the Umeå 85+/GERDA interview study, where 65 and 75 year-olds in same areas in Finland and Sweden answered a questionnaire the year 2005 and 2010. There was a tendency that discrimination changed in a positive direction (Snellman et al., 2013). If the tendency toward decrease in ageism also concerns the very old, then there might be a positive change on morale over the 15 years the PGCMS have been tested in the Umeå 85+/GERDA study. The weakest old frail individuals are, however, likely to have the biggest problems making their voices heard and fight against ageism.

Next part of the presentation of refining the model for morale is a description of morale used as an outcome (dependent) variable is presented in Figure 28.
MORALE IN VERY OLD PEOPLE

Morale as an outcome variable

- Treatment
  - Positive attitudes toward own aging
  - Emotional Resources
  - Social Resources

Adverse life event

Background factors that might affect morale

Micro level – Individual
- Genes (?), Upbringing (?)
- Gender, personality
- Psychological health
- Physical health/diseases
- ADL-function
- Vision/hearing impairment
- Religion/spirituality
- Education (?)
- Changes over time

Meso level – Inter-individual
- Social network
- Living alone
- Home environment
- Aids
- Home care
- Socio-economical status

Macro level – society
- Attitudes – Ageism
- Laws and rules
- Pensions/Taxes
- Healthcare and Aid systems (?)

Figure 28. Refined model for morale
**The PGCMS as an outcome (dependent) variable**

To be able to use the PGCMS as an outcome variable, it must be able to detect changes, resulting either from an adverse life event, as in Paper II, or from therapy intended to increase morale or other variables. A prerequisite for this is that morale can change and one study supports this (Scott and Butler, 1997). The three components of morale, positive attitudes toward own ageing, emotional and social resources can all change and therefore it seems logical that morale itself can change. The decrease in ICC, as described in the results section (Tables 4 and 19), suggests that the PGCMS is able to detect changes over time. Since there is probably some stability in the morale level of an individual over time, another question is how sensitive the PGCMS is to changes, i.e. how strong or important does the adverse life event or therapy have to be for the PGCMS to detect a change. It seems logical that such a change must at least be larger than the measurement error (Table 4) between two measurements.

For a scale to be useful in research, it is also important that there is no ceiling or floor effect. “Ceiling effect” is when most respondents’ answers often score the maximal points for the scale and the “floor effect” is when respondents’ answers often score the minimal points for the scale. It seems that the PGCMS does not suffer much from ceiling or floor effects, even if there is a tendency for more answers to score towards the higher end of the scale in the Swedish and Finnish very old populations examined in this thesis. However, the average answers were lower in a younger, Spanish sample (Benito-Leon et al., 2010). There could be many reasons for the difference between the Spanish and the Swedish/Finnish populations, the most obvious being either the age difference or cultural aspects, but there is also the possibility of translational differences in the PGCM scale. Although the scale could probably be used in a similar way in different cultures, there might be different levels of morale in different cultures or countries.

Increasing or boosting morale – possible intervention

There have been very few attempts to increase morale by means of interventions. Conradsson et al reported an increase in morale, measured using the PGCMS, with an exercise program over three months among people with dementia, where the control group received a social activity program (Conradsson et al., 2010). It is not known by what mechanism exercise increases morale.
It seems that future treatment efforts should target one or all of the three sub-scales or aspects of morale, emotional, social and cognitive factors. This assumes that to a certain degree basic needs have been met (food, somewhere to live, healthcare, etc.) as they are in most western European countries. Some conclusions can be drawn from the research on morale.

Emotional resources

From the point of view of emotional resources, it seems logical that one of the most important strategies is to find and treat depression. Additionally, it also seems logical to optimize treatment of various disturbing symptoms such as pain, angina pectoris and similar troubling symptoms. Boosting the positive side of the emotional resources is having fulfilling hobbies and leisure activities could help reduce boredom and build new social connections. Religious and spiritual activities could help the acceptance of the unavoidable changes that come with ageing, and possibly helping gerotranscendence.

Social resources

From the social resources point of view it seems logical that action against social isolation and loneliness could be important. It is likewise important to make sure that the quality of the contacts is high, not just an increase in the number of visits from medical or nursing care. It also seems logical that it is important to treat hearing disabilities and to improve talking skills after a stroke with aphasia. On a society level, economical support through higher pensions to very old people might also help improve socio-economic status.

Positive Attitudes Towards Own Aging

Attitude treatment could involve therapies that help a person to accept and to adapt to the inevitable changes that come with age. Treatment intended to improve morale is certainly not an easy task; it would be like trying to make a pessimist into an optimist. The most obvious treatment choice is cognitive psychotherapy. Another approach that could also be helpful is self-help strategies, such as the 12 steps to increase happiness suggested by Lyubomirsky (with some adaptation) see below (Lyubomirsky, 2007).
1. Express gratitude
2. Cultivate optimism and think positively
3. Avoid overthinking and stop comparing oneself with others
4. Practice acts of kindness
5. Nurture social relationships
6. Develop strategies for coping and learn how to persevere
7. Learn to forgive
8. Increase flow experiences
9. Taste the joys of life
10. Commit to your goals and set new goals
11. Practice religion and spirituality
12. Take care of your body (meditation, physical activity and act like a happy person).

However, clearly the 12 suggested steps require substantial cognitive resources.

Interventions changing attitudes need not only be on an individual level. One can also try to address attitudes in society such as ageism with different types of campaigns and tv-shows. This might increase morale in very old individuals.

Adverse (negative) event – reduction in morale

As previously mentioned, stroke is one possible adverse life event that seems to be able to reduce morale in many individuals. There are, of course, other adverse life events with this capability. Depression would most probably affect morale by affecting the emotional resources of morale. Problems in communication, either through loss of speech (aphasia) or hearing abilities could affect the social resources of morale. A number of losses might affect
the positive attitudes toward one’s own aging, such as serious illnesses, loss of family member or close friends, loss of role, and loss of the ability to take care of oneself. We also do not know the effect of having several chronic diseases without symptom control.

Returning to the initial question of whether the PGCMS can be used as an outcome variable, morale is a multidimensional concept and probably has some stability. However, based on the data in this thesis, it seems that the PGCMS is capable of detecting change.

Finally, a description of morale used as an explanatory (independent or predictor) variable is presented in Figure 29.
MORALE IN VERY OLD PEOPLE

Morale as an outcome variable

Treatment

Adverse life event

+ Positive attitudes toward own aging

Emotional Resources

Social Resources

- Better survival
  - Lower incidence of depression

+ Worse survival
  - More falls

Morale as an explanatory variable

Background factors that might affect morale

Micro level – Individual
- Genes (?), Upbringing (?)
- Gender, personality
- Psychological health
- Physical health/diseases
- ADL-function
- Vision/hearing impairment
- Religion/spirituality
- Education (?)
- Changes over time

Meso level – Inter-individual
- Social network
- Living alone
- Home environment
- Aids
- Home care
- Socio-economical status

Macro level – society
- Attitudes – Ageism
- Laws and rules
- Pensions/Taxes
- Healthcare and Aid systems (?)

Figure 29. Refined model for morale
The PGCMS as an explanatory (independent) variable

There are only a few studies that examine the effect morale may have on other variables. Benito-Leon et al studied low morale and its effect on five-year mortality (Benito-Leon et al., 2010) and Anstey et al who studied how low morale is a predictor of falling in the following eight years (Anstey et al., 2008). Anstey et al observed that a one-point reduction in the PGCMS score was associated with a six percent increase in case frequency of falling over eight years, even after adjusting for confounders. In addition, none of the earlier studies examining the effects of morale has specifically studied very old people.

The new approach in this thesis is to change the perspective and examine the salutogenic effect of high morale. High morale can have an impact by reducing the incidence of depression (Paper III) and increasing the five-year survival rate (Paper IV). This suggests that morale can be used as an explanatory variable. It also draws attention to the question of what the mechanisms are that lie behind the salutogenic effect. Possible salutogenic mechanisms of high morale are presented below.

Behaviours

Behaviours that might explain the salutogenic effect of high morale could be increased engagement in social networks and self-care behaviours (exercise, eating healthy food, avoiding smoking and excessive alcohol) (Pressman and Cohen, 2005).

One can speculate that education might be the mediator for some of these healthier behaviours. In a younger sample than that used in this thesis, Benito-León reported a higher level of secondary or tertiary education among those with high morale and greater degree of illiteracy among those with low morale, but there seemed to be no difference for those in-between with primary level education (Benito-Leon et al., 2010). This difference in level of education was not used in the work in this thesis, which could explain why there were no significant differences between level of morale and level of education (Table 10 and 15).
Psychological

A higher psychological resilience and being better at handling emotions could explain the salutogenic effects of high morale. One might speculate that older people, possessing the wisdom of a whole lifetime, are better in general at handling emotions than young people. Family and friends can also promote psychological support. The cognitive aspects that could possibly explain the salutogenic effect of high morale are more efficient coping strategies and thus more positive attitudes. The possible effect of the positive attitudes towards own aging (PATOA) on morale is described in more detail below.

Physiological

There is a known connection between mind and body, and high morale could influence for instance the immune defence and endocrine systems in the body in a way that is similar to how wellbeing is believed to increase survival (Pressman and Cohen, 2005).

Health

High morale is associated with a good health among old people (Wenger et al., 1995), which means that they are less prone to frailty or pre-frailty. There is no study, to my knowledge, that explores the correlation between the level of morale and the level of frailty. One can speculate that there is a rather strong correlation between frailty/pre-frailty and low morale, which could be part of the reason why high morale is associated with higher five-year survival (Paper IV) and reduced risk of falling (Anstey et al., 2008). However, it is difficult to design a study that is able to determine what comes first, a decline in health that results in a decline in morale or a decline in morale that results in a decline in health. Better health is also more common among the younger old people.

Sub-scales of the PGCMS explain the effect

Was the salutogenic effect seen in Papers III and IV an effect of one of its sub-scales? The only sub-scale that has previously been tested regarding
survival was Attitudes Toward Own Aging (ATOA). Positive attitudes toward own aging has previously been found to be associated with survival even after adjusting for a comprehensive set of confounders (Levy et al., 2002). In Paper IV, there was no association between survival and ATOA or any other of the sub-scales in the multi-variable confounder model. It seemed that all three resources - emotional, social and PATOA - are needed to increase the survival effect, at least among very old people.
Methodological discussion

General issues

The result of a study can already be affected in the planning and financing stage. As far as we know, the Umeå 85+/GERDA study was not subject to any influences from political, financial, gender or similar causes. There were no conflicts of interest and the sole objective was carrying out research that was as reliable and powerful as possible.

When gathering data and creating computerbased databases there are several things that can go wrong. The answers from the participants might be incorrect noted on papers that are used during the interview. There might also be faults when later entering the data into computers. Perhaps it would exclude some of these errors if computers, such as iPads, were used when data was collected during interviews.

One challenge when interpreting these data from the point of view of age is that not all those aged 85 years and older were included, as three different age groups were used instead. Since only every other 85-year-old was included while everyone aged 95 years and older was offered participation, the 85-year-olds are relatively under-represented. However, each of the three groups is representative of their general age group.

Each point or score on the PGCMS is not necessarily equally important or large, unlike the markings on a thermometer or a tape measure. A Rasch analysis has been performed on the PGCMS (Ma et al., 2010) but it was not aimed at clarifying the issue.

The populations in Sweden and Finland have many similarities but also some differences. We have chosen to merge the samples whenever possible.

There was a slight difference in the definition in two of the measures used in the Papers included in this thesis: education and social contacts. It is unlikely it has made an important impact on the endresult.

External validity

Selection of potential participants is based on the tax authorities’ population registers, which in Sweden and Finland are considered to be of high quality,
making it probable that a very high proportion of the intended population was asked to participate. A large number of respondents accepted the invitation to participate in the study despite advanced age and a high incidence of disease. The inclusion of not only those living in the community but also those living in institutional care should lead to a study population that properly represents the age group of very old people. This supports the external validity, although not all of them completed the PGCMS.

Internal validity

There are different ways to acquire knowledge about these very old people. One way is to try using indirect information from registers or relatives or caregivers. Another way is to get information from the individuals’ themselves, directly, either through surveys sent home by mail or home visits with interviews. This study is based on home visits with quantitative interviews and assessment scales answered by the participants, interviews with relatives and caregivers as well as data extracted from medical records.

To improve the performance, interviewers received training before their first interview. During the interview period, formal meetings took place where the interview procedure and how the answers should be entered into the database were discussed.

All diagnoses in the Umeå 85+/GERDA study have been determined using the same method and by the same person, an experienced geriatrician. For example, depressive disorder diagnoses were determined throughout the period according to DSM IV TR criteria, ensuring both the quality of the diagnoses and that they were consistently determined.

Procedure issues

To interview someone in their own home means that the interviewer needs to build trust with the interviewee. Today’s telemarketing and increasing crime rates, directly targeting them, mean that very old people have become healthily suspicious of strangers. Some questions were more difficult to ask than others, such as questions about their economic situation. The interviewers were also attentive to the need to take a break if the old person being interviewed showed signs of getting tired.
Generalizability

Cognitive impairment is common in the age group studied. This could affect the data reliability and thus the generalizability. However, it is easier to answer a “yes” or “no” question in the PGCMS than the Likert scales, where a number of answers are possible. Each individual was assessed on whether he or she could respond adequately to the PGCMS, despite cognitive impairment, which meant that even people with low MMSE could answer the questions. In this study the opportunity to use proxy answers, i.e. when a relative answers the questions instead of the person him or herself, was not used.

Limitations of the Papers I-IV

In Paper I, the psychometric properties of the PGCMS were tested on individuals with a wide range of scores, ranging from 1 to 17 points. The sample sizes were large considering the very old age group. The participants were tested in their own homes, including those in institutional care facilities, to ensure good agreement with real clinical settings for very old people.

In Paper I, the proportion of participants living in institutional care was high in the convenience sample, 72.2%, due to the selection process and this might limit the external validity. The reliability, however, was good. A majority of participants in both samples were women but since the participants were of a very advanced age a majority of women was to be expected.

In Papers II, III and IV a wide range of variables were included known to affect wellbeing among old people in general in areas of physical, functional, psychological, social, economic, and spiritual aspects of wellbeing (Carod-Artal and Egido, 2009, Inder et al., 2012, Lau and McKenna, 2001, Loke et al., 2011). Yet, there are still other variables known to affect morale, such as personality traits, that were not recorded in the Umeå 85+/GERDA study.

In Paper II, only about two thirds of those with a history of stroke were able to answer the PGCMS. The significantly lower MMSE mean score among those who were unable to answer PGCMS questions suggests that in most cases a cognitive dysfunction could explain their inability to do so. However, the sample still included many individuals with cognitive and speech impairments.

The limitation of Paper III was that many of the participants died before the follow-up due to advanced age and the fairly long follow-up period, which
might limit the generalizability of the results of the study. No temporary depressive disorder during the five-year follow-up was recorded. One aspect known to be associated with high morale, an adequate financial situation (Wenger et al., 1995), was not used in the study due to a rephrasing of the questions between the two baseline data collections. The possibility cannot be ruled out that we might have detected additional associations, which could have been used as confounders, if a shorter follow-up period had been chosen considering the age and potential frailty of the study group. The five-year mortality seems to be significantly higher among those with depressive disorders at baseline compared to those without, however we lack data about what happened between baseline and follow-up.

In Paper IV, considering the advanced age, with possible age-related health problems and concomitant disease, a high proportion, 76% (646/850), of the study population answered the PGCMS. There are limitations to Paper IV. It was not noted why 24% (204/850) of the older people did not answer the PGCMS, which may affect its generalizability. The selection of confounding factors used in this study can affect the result and there are variables known to affect morale such as personality traits not measured in the present study.

In this thesis educational level was used in different ways. We chose to dichotomize the level of education above or below seven (Paper II) or six (Paper IV) years and this divided the material into approximately two equal halves and in Paper III, it was used as a continuous variable. However, we have not examined those with a higher level of education specifically.

**Clinical implication**

The PGCMS as a test of quality of life is easy to administrate and its use is feasible among very old people. The PGCMS is valid and reliable. It seems useful in predicting depressive disorders five years later and five-year survival. If the PGCMS proves able to demonstrate a strong correlation with frailty, the instrument would be suitable for use as part of a Comprehensive Geriatric Assessment in hospitals as well as in institutional and elderly home care.

If depression, hearing impairments and angina pectoris could be improved this might lead to improved morale among very old people with a stroke history.

If low and moderate levels of morale could be improved through appropriate interventions, it would not only improve wellbeing but might also reduce the
number of new cases of depressive disorders and increase five-year survival. Interventions should be aimed not only at treating diseases or other factors associated with low morale among frail, old individuals, but should also target factors that would boost the morale of the very old.

Viewing morale as a possible salutogenic factor and look at the three factors, which comprise it as resources, might lead to finding different strategies to discover factors that promote health among very old people.

Future research

A possible future research project would be a randomised control trial to discover whether the interventions suggested in this thesis targeting morale and the three factors that comprise morale. If it can improve morale in very old people and whether it also further reduces the incidence of depression and improves five-year survival. Perhaps it would also be possible to address the question of whether the three factors of morale are equally important.

Stroke rehabilitation is a team effort. Today much of hospital stroke rehab is focused on stabilizing vital functions, secondary prevention, regain lost function, prevent secondary illness or complications, and in practical ways assist the individual's reintegration into society. Those are all important strategies, but from this thesis, one could argue for studies that focus on helping the individual in a more focused way with cognitive, emotional and social support. This could be done through improving coping and attitudes with targeted counselling, supporting social capital with counselling family members and encourage the individual to new social activities based on the persons interests and capabilities, and try to find ways to improve the emotional crisis that a severe stroke normally causes. Post stroke depression is often difficult to treat. A possible research area could be to closer study the association of morale with different amino acids in the brain or even areas of the brain involved in high morale, in order to design better therapy.

If the PGCMS can be used to detect who will have a depressive disorder five years later, among those without depressive disorder, perhaps it is possible to identify treatable risk factors. Future studies could focus on whether the PGCM scale could be used among very old people to determine who would benefit from a longer period of medical treatment for depression and who would most likely benefit from ending the treatment.
It seems important to use longitudinal studies to further explore the natural course of morale. Another question is how intense adverse events or interventions must be for PGCMS to be able to detect a change. In addition, do mid-life risk factors influence the morale of very old people?

Strengthen the social resources to fight loneliness among very old people can be done in many ways. For those who still have the strength, exercise in groups seems as an appropriate intervention to study further. In the light of gerotranscendence, supporting, religious or spiritual activities could also be important. Since more old people are familiar using computers nowadays, for those who do not have the strength to attend group meetings, might modern technology with tele-video communications such as Skype could be used, and the way to find new friends could use similar techniques as modern network dating sites.

Attitudes toward own aging is important for very old people. It is common to hear old people say that they feel they have ended their life’s journey and they say that they have nothing to live for, even though they seem to have long time left to live. Qualitative interviews to better understand the causes of their feelings are probably the first step to understand the reasons why they feel as they do. This can later lead to quantitative studies to confirm the result that later can be used in treatment trials.

**General Conclusion**

Morale among very old people is explored in this thesis. The PGCMS is used as an outcome measure, i.e. a measure of psychological wellbeing or quality of life, and it is also used as an explanatory variable.

The Swedish version of the PGCMS, the most widely used scale for measuring morale seems to have satisfactory psychometric properties and its use is feasible among very old people.

Since stroke has a high prevalence among very old people, it was chosen as the example through which a better understanding of adverse events affecting morale could be obtained. Those with a history of stroke appear to have lower morale, although more than one third of those with a stroke history may be considered to have high morale. Depression, angina pectoris and hearing deficit seem to be independently associated with low morale among very old people who had had a stroke.
High morale was explored for its salutogenic properties, which could affect other health-related factors. Our results suggest that the higher the morale, the lower the risk of depressive disorders five years later among very old people and high morale is independently associated with increased five-year survival among the very old.

Finally, the salutogenic view of high morale led to a positive view of the factors that comprise morale and the model for morale was refined using both previous research and the results of Papers I to IV, included in this thesis.
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Appendix

THE PHILADELPHIA GERIATRIC MORALE SCALE (PGCMS) – Swedish version/Svensk version

Ringa in det svar personen ger. Vid uteblivet svar, repetera frågan.

1. Blir saker och ting värre allteftersom du blir äldre? Ja Nej
2. Har du lika mycket energi nu som för ett år sedan? Ja Nej
3. Känner du dig väldigt ensam? Ja Nej
4. Träffar du släkt och vänner tillräckligt ofta? Ja Nej
5. Bekymrar du dig mer för småsaker nu än för ett år sedan? Ja Nej
7. Oroar du dig ibland så mycket att du inte kan sova? Ja Nej
8. Nu när du har blivit äldre, har saker och ting blivit bättre än du hade förväntat dig? Ja Nej
9. Känns det ibland som om livet inte är värt att leva? Ja Nej
10. Är du lika lycklig nu som när du var yngre? Ja Nej
11. Har du mycket att vara ledsen över? Ja Nej
12. Är du rädd för en massa saker? Ja Nej
14. Är livet hårt mot dig för det mesta? Ja Nej
15. Är du tillfreds med ditt liv idag? Ja Nej
16. Har du lätt att ta illa vid dig? Ja Nej
17. Blir du lätt upprörd? Ja Nej

Ett poäng per markerat svar med fet text. Ju högre poäng, desto högre välbefinnande. Summa_
THE PHILADELPHIA GERIATRIC MORALE SCALE (PGCMS) – British English Version

1. Do things keep getting worse as you get older? Yes No
2. Do you have as much energy as you did last year? Yes No
3. Do you feel lonely much? Yes No
4. Do you see enough of your friends and relatives? Yes No
5. Do little things bother you more this year? Yes No
6. As you get older do you feel less useful? Yes No
7. Do you sometimes worry so much that you can’t sleep? Yes No
8. As you get older, are things better than expected? Yes No
9. Do you sometimes feel that life isn’t worth living? Yes No
10. Are you as happy now as you were when you were younger? Yes No
11. Do you have a lot to be sad about? Yes No
12. Are you afraid of a lot of things? Yes No
13. Do you get mad more than you used to? Yes No
14. Is life hard for you most of the time? Yes No
15. Are you satisfied with your life today? Yes No
16. Do you take things hard? Yes No
17. Do you get upset easily? Yes No
THE PHILADELPHIA GERIATRIC MORALE SCALE (PGCMS) – American English (original) version

1. Things keep getting worse as I get older. Yes No
2. I have as much pep as I had last year. Yes No
3. How much do you feel lonely? Not much A lot
4. Little things bother me more this year. Yes No
5. I see enough of my friends and relatives. Yes No
6. As you get older, you are less useful. Yes No
7. I sometimes worry so much that I can’t sleep. Yes No
8. As I get older, things are (better/worse) than I thought they would be. Better Worse
9. I sometimes feel that life isn’t worth living. Yes No
10. I am as happy now as I was when I was younger. Yes No
11. I have a lot to be sad about. Yes No
12. I am afraid of a lot of things. Yes No
13. I get mad more than I used to. Yes No
14. Life is hard for me much of the time. Yes No
15. How satisfied are you with your life today? Satisfied Not satisfied
16. I take things hard. Yes No
17. I get upset easily. Yes No

Note: Questions numbers 4 and 5 have reversed positions compared to the Swedish and British English versions
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